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New Zealand Geographer

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THE GOLDEN AGE: NEW ZEALAND ABOUT 1867

R. P. HARGREAVES

IN THE 1860's the difference in the rate of progress and development of the two islands of New Zealand was most marked and was reflected in the respective landscapes. The still predominantly forest-covered North Island stagnated, for these were years of bloodshed between the pakeha and Maori. Not until 1872 did the last skirmish occur between the two races, while fear and suspicion lived on for many years.[1] The Maori still legally owned about two-thirds of the land of the North Island, and difficulties in purchasing it further hindered settlement. In comparison the Middle Island—as the South Island was then popularly known—with its wide expanse of open grassland, forged ahead, for there the Maori was almost non-existent, and by 1860 the Crown held title to all the land not already freehold. Land was thus easier to obtain, and being free from the threat of native attack, proved more attractive to immigrants. Equally significant was the impact of the major gold discoveries in Central Otago and on the West Coast of the Middle Island. As a result of a combination of these factors the Middle Island was the 'mainland' in population numbers, value of trade, sheep and cattle numbers, area cropped, development of communications, and in many other ways. This lead was maintained for a number of years, and in 1867, even more than in 1881, the Middle Island was politically and economically truly ascendant, basing its wealth on the golden fleece and the golden metal, both of which it produced in abundance.[2]

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[1] See J. K. Cunningham: 'Maori-Pakeha Conflict 1858–1885: A Background to Political Geography', *N.Z. Geographer*, Vol. 12, No. 1, April 1956, pp. 12-31.

[2] For the historical geography of the 1870's see K. B. Cumberland and R. P. Hargreaves: 'Middle Island Ascendant: New Zealand in 1881', *N.Z. Geographer*, Vol. 11, No. 2, October 1955, pp. 95-118, and Vol. 12, No. 1, April 1956, pp. 51-74. For the period preceding, see K. B. Cumberland: 'Jimmy Grants and Mihaneres: New Zealand about 1853', *Econ. Geog.*, Vol. 30, No. 1, January 1954, pp. 70-89.

The provincial form of government had been instituted in the colony by an act passed by the British Parliament in 1852, although provincial boundaries were not created until early in the following year. A central government existed at Wellington but its authority and powers of cohesion in the young nation were relatively weak.[3] Each province had its own interests of which it tended to be jealous, so that separateness of settlements still existed in political outlook if not so much in actual physical isolation. Symptomatic of this was the growth in the number of provinces from the original six to nine in the fourteen years the constitution had been in force.[4] Areas which felt that their interests were not being sufficiently attended to agitated for self-government, and the latest move in this direction had come from Westland. In 1867 some measure of autonomy was achieved when it was declared a separate county, while six years later full provincial status was obtained.

The Middle Island, economically booming, was becoming loath to spend money helping the settlers of the north to fight a war which the southerners considered no concern of theirs. As a result, separatism and provincialism versus centralism became a feature of the political life of the colony until, in 1876, the provinces were finally swept away and New Zealand was once more under a single centralised authority.

EXTENSIVE PASTORALISM

In the 1860's New Zealand was basically a farming country on which had been superimposed a veneer of feverish goldmining activity. Although for the years 1861-1871 gold was the single most important export, it was in reality just a passing, but important, phase in the colony's history. As an astute observer of New Zealand noted at the time: 'the great, safe, sure and *permanent* King Export of New Zealand is not Gold but the "Golden Fleece" '.[5]

The agricultural occupance of land had expanded considerably over the previous decade. Instead of being concentrated in the immediate vicinity of the settlements, farming in 1867 utilised in some way more than a quarter of the total area of the colony, predominantly in the Middle Island where the squatters had spread over and occupied for sheep runs the full extent of the natural grasslands.

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[3] In 1857 an English visitor had drawn attention to the inefficiency of the provincial system, saying: 'With six local governments and a general assembly, in place of *one* efficient government for the entire colony, it is perhaps not to be wondered at that the general good is sometimes retarded or sacrificed to the local or provincial elements of jealousy, malice or ambition.' See [D. Pusely]: *The Rise and Progress of Australia, Tasmania, and New Zealand*, London, 1857, pp. 240-241.

[4] The six original provinces were Auckland, Taranaki, Wellington, Nelson, Canterbury and Otago. In 1858 Hawkes Bay became a province separate from Wellington, in 1859 Marlborough Province separated from Nelson, and in 1861 Southland Province separated from Otago.

[5] Charles F. Hursthouse: *The New Zealand of Today*, London, [1867], p. 16.

SIGNIFICANCE OF SHEEP

Since the earliest introduction of sheep from Australia, the total number had continuously increased from year to year without exception. Between 1858 and 1867 sheep numbers had jumped from 1,523,324 to 8,418,579.[6] In the latter year more than three-quarters of the sheep were to be found along the eastern plains and hill country of the Middle Island (*Fig.* 1) where they grazed on the natural pasture. In order to provide the sheep with young, more succulent, grasses the tussock was burnt off every year, usually in summer. Whether this was a wise action or not was already being debated, and writers were beginning to point out that the tussocks lost strength under continuous firing and would eventually disappear or be replaced by other grasses and plants.[7]

As only a limited market existed for meat on the goldfields and in the urban centres, and as no satisfactory means of preserving lamb and mutton for transport overseas was known, the production of wool was the primary consideration. Exports had risen from 1,071,340 lbs in 1853, to 27,152,966 lbs in 1867, more than four-fifths of the latter being shipped from the Middle Island.[8] Shearing was carried out by itinerant gangs in which Maoris often played an important part, and a good man could shear a hundred sheep in a day. Other minor products exported were skins and tallow, the latter being obtained by boiling down surplus and old sheep, a practice which was becoming more and more widespread as runs became fully stocked.

The merino, prized for its fine fleece, constituted the dominant breed, particularly in the Middle Island where it was occasionally crossed with the Cotswold or other long-woolled sheep. In the North Island a greater variety of breeds was found, including, besides the merino, the Leicester, which was the most popular, the Cotswold,

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[6] *Statistics of New Zealand, 1867*, Wellington, 1869, Part I, Census No. 26.

[7] Alfred Saunders: *New Zealand*, London, 1868, p. 6; J. Buchanan: 'The Botany of Otago', *Trans. N.Z. Institute*, Vol. 1, Pt. 3, 1868, p. 23.

[8] *Statistics of New Zealand, 1867*, Part II, Table 28. Provincial exports were: Auckland 477,338 lbs; Wellington 2,824,437 lbs; Taranaki 9,279 lbs; Hawkes Bay 1,156,819 lbs; Nelson 534,297 lbs; Marlborough 1,058,965 lbs; Canterbury 11,232,948 lbs; Otago 8,317,079 lbs; Southland 1,541,804 lbs.

Southdown, Lincoln and the Hampshire Down, as well as various crosses. There, on the small semisubsistence mixed farms on former bush and fern land, meat was often a relatively more significant product, for the merino was ill-suited to meat production, besides which it did not fare as well in the damper climate of the north.

Sheep runs in the Wairarapa in the North Island and in the Middle Island, often covering thousands of acres, were generally held on pastoral leases from the government with only strategic areas, such as round the homestead and along the streams, freehold. In all, more than thirteen and a half million acres were held on lease for farming purposes in 1867, more than eighty-six percent being in the Middle Island where little land remained to be taken up.[9]

Occasionally there was still practised a once more common system of sheep farming—the stock being run 'on terms'. Under this arrangement the small capitalist who could not yet afford—or obtain—a run would contract with a big station owner who could not fully stock his lease for permission to pasture his sheep with the runholder's flock. The agreement was for a stipulated number of years, usually three to five. The terms of payment varied, but a common arrangement was that the runholder received a third of the wool and a third of the lambs each year for looking after the flock. At the end of the period the original number plus the increase, without allowance for deaths, was returned.[10] For the colony as a whole, lambing was estimated to be between eighty and ninety percent, although the average percentage varied from district to district; for example, in Southland, it was estimated to be only seventy-five to eighty.[11] While there was a slight tendency toward spring lambing, it often took place in winter and even all year round, for the lack of fencing on most runs meant that complete control was not possible. This indiscriminate time of lambing was a factor in keeping down the percentages.

Problems of Sheep Farming

Among the problems faced the most serious was scab. It is thought that this disease first entered New Zealand from Australia in the mid-

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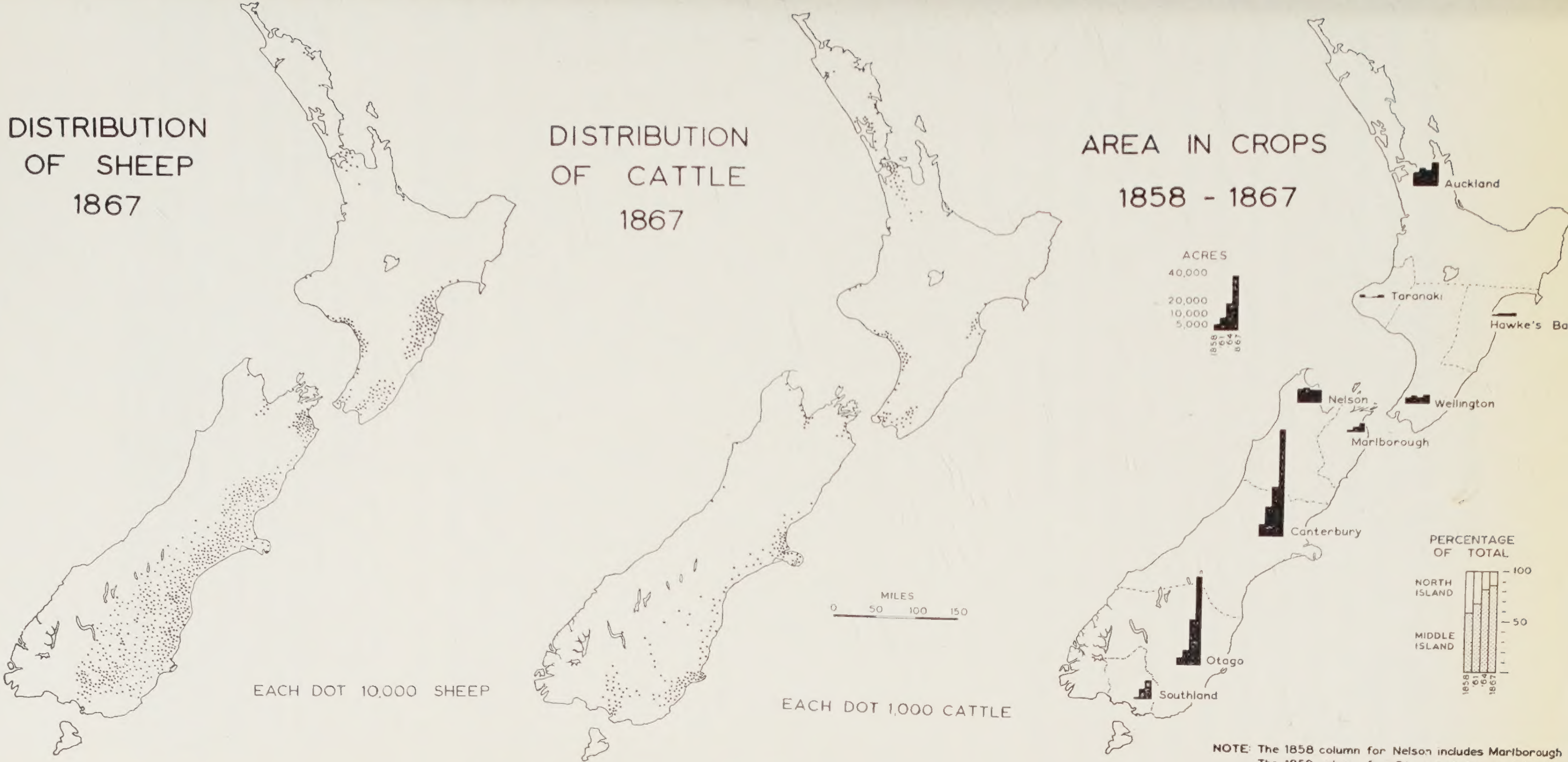
[9] *Statistics of New Zealand, 1867*, Part I, Census No. 21. The area occupied as freehold was more than five million acres, 56 percent of which was situated in the Middle Island.

[10] Sometimes the agreement would stipulate that the owner would receive a monetary payment in lieu of wool, for example, 2s. 6d. a head, and 40 percent of the increase (Samuel Butler: *A First Year in the Canterbury Settlement*, London, 1923, [first published 1863], p. 38).

[11] *The Press*, Christchurch, 5 March 1867, p. 2.


DISTRIBUTION OF SHEEP 1867

DISTRIBUTION OF CATTLE 1867

AREA IN CROPS 1858 - 1867

NOTE: The 1858 column for Nelson includes Marlborough
The 1858 column for Otago includes Southland

Figs. 1, 2 and 3. Distribution of sheep and cattle in 1867, and area under crops, by provinces, 1858–1867

1840's when some infected sheep were imported into the Wairarapa. Being highly contagious, scab[12] quickly spread through both islands, because of the lack of effective control. The appearance of scab was dreaded on every holding, and in an attempt to insure against it many runholders dipped all their sheep in a strong solution of turpentine and tobacco-water once a year. Diseased sheep were treated with a variety of remedies, including sulphur, arsenic and spirits of tar dressings.[13]

On most runs only a few acres round the homestead were ploughed for crops. Oats, generally the most significant crop, were grown for feed for the numerous horses, while a little wheat might be harvested for home consumption. A few cattle were generally run, again mainly for use as food on the station and perhaps for draught purposes.

CATTLE FARMING

While cattle were far fewer in number than sheep, there being only 312,337 in the colony, the grazing of such animals nevertheless played a significant part in New Zealand farming. Figure 2 shows their distribution in 1867, when more than three-fifths were to be found in the Middle Island. Like the sheep, the majority of the cattle were descendants from stock originally imported from Australia. As yet little attention had been paid to breeding, although 1867 saw the publication of the first herd book for Shorthorns which, with Durhams, were the most prominent strains.[14] Cattle farming was more general than dairying, and the animals were raised not only for meat, but just as often as draught animals, for bullocks were favoured in the bush country and on the more distant sheep stations. Only where surface conditions were better were horses used to haul the waggons because of their greater speed and utility.

Commercial dairy farming was resorted to only in close proximity to its markets, the nucleated settlements, for the problem existed of how to convey the products any distance without their spoiling. Since the time of the first Australian goldrush small quantities of butter and cheese, packed in a variety of ways for preservation, had been sent from New Zealand to the neighbouring colonies. Canterbury cheese—or as it was known on the Australian market 'Port Cooper cheese'—had become the most sought after because of its quality, and commanded the highest price in Australia. However, the quality of the dairy products of New Zealand was in no way consistent, for all the processing was carried on at home and depended on the farmer's skill and cleanliness. As dual-purpose cows were of greatest utility, pure dairy breeds were in little demand, although it is recorded that the first pure Jerseys were imported in 1862 by a Wanganui purchaser.[15] Such dairy breeds did not gain general acceptance, however, until refrigeration had opened up an expanded and seemingly permanent market overseas which allowed for specialisation.

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[12] With this disease intense irritation, and ultimately the forming of scabs due to rubbing or biting, was caused by the burrowing of a minute insect into the skin of the sheep. All the animals afflicted by this disease soon lost condition and much of their wool, and many died.

[13] Most provincial governments attempted to control the spread of scab. Canterbury issued a Provincial Ordinance in 1858 which made it obligatory for owners to report the appearance of scab to their neighbours within 48 hours, to specially brand the infected sheep, and to see that the flock was closely herded and watched. Fines were imposed if these provisions were not complied with, but a stringent application of anti-scab laws was not uniformly applied throughout New Zealand and the colony was not declared 'clean' until 1892.

[14] See G. S. Whitmore: *N.Z. Herd Book, Containing the Pedigrees of Improved Short-Horned Cattle*, Vol. I, Napier, 1867. In all it listed 27 pedigree bulls and 24 pedigree cows. The Herd Book was very incomplete and cannot be regarded as an accurate guide, for it had very few references to animals in the Middle Island, the majority being from Hawkes Bay where the author had a cattle station.

The area ploughed and planted to grain and root crops (*Fig.* 3), as well as in English grasses (*Fig.* 4), expanded enormously with the increased demands for food following the gold discoveries, first in Australia and subsequently in the Middle Island. At the same time the presence of troops in the North Island further increased the demand for agricultural produce. Although the area in crops in the North Island showed an absolute increase for the period 1858–1867, the rate of increase was less than that in the Middle Island where the virgin lands of the plains and downlands were rapidly coming under cultivation. As a result, the percentage of the total area cropped to be found in the Middle Island jumped from fifty-nine to eighty-six over the nine years (Inset *Fig.* 3). Likewise the area in sown grasses in the Middle Island expanded at a faster rate than that in the North Island, and its proportion of the total in 1867 was forty percent compared with sixteen percent in the earlier year (Inset *Fig.* 4).

CROP GROWING

Of the grains, oats were the most important in 1867, particularly in the Eastern Middle Island region (*Fig.* 5), and were grown to provide green feed, oaten hay and the ripened grain itself. Wheat for flour was cropped throughout the colony, but generally all areas except eastern Middle Island were forced to import supplies to make up deficiencies.

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[15] H. G. Philpott: *A History of the New Zealand Dairy Industry*, Wellington, 1937, p. 24.

The New Zealand problem of scarce and expensive labour had so far prevented the development of the large grain farms that became characteristic in the 1870's, for there was as yet little machinery available to surmount the difficulty. The first threshing and winnowing machines were being introduced from England and America, particularly into the southern provinces, and in some cases such machines were even manufactured in New Zealand. They tended to remain, however, a novelty rather than an essential feature of farm operations.

Grain was usually grown in the same paddocks year after year without manure, and although some farmers had noted a decline in yields because of overcropping, few saw any need to apply a remedy in the form of fertiliser. Grain crops, whether they were grown on the small bush clearings of Auckland or in large fields on the sweeping plains of Canterbury, were attacked by rust and smut diseases, and agriculturists sought to prevent this by steeping the seed in bluestone before planting. Caterpillars, grasshoppers and other insects were a problem and did great damage both to standing crops and pasture. One Napier paper estimated that the caterpillar had destroyed in Hawkes Bay 'one third of our agricultural produce for the year'.[16] A demand existed throughout the country for the importation and release of small English birds such as the sparrow and rook as a means of combating the pests, and acclimatisation societies received general support for any moves made to fulfil this want.[17]

Bush Farming

Other than in the Ahuriri–Wairarapa region, the majority of the North Island farms were engaged in mixed farming which occupied former bush land. Cattle and a few sheep and pigs were kept, while crops were grown to provide food for the farm family, with usually a small surplus to be sold in the nearest urban centre. Crops also provided supplementary feed for the stock, although on the fringes of settlement cattle were often allowed to forage for themselves in the nearby bush, particularly during the winter months. In most areas crop growing was regarded only as a preliminary to laying down pasture, and the acreage of sown grasses had expanded considerably over the previous decade in all North Island provinces except Taranaki (*Fig.* 4). Sown

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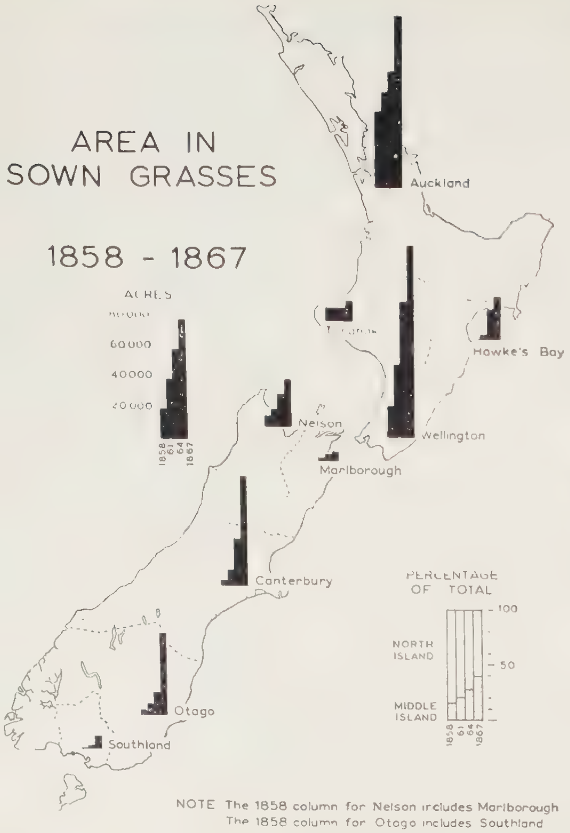
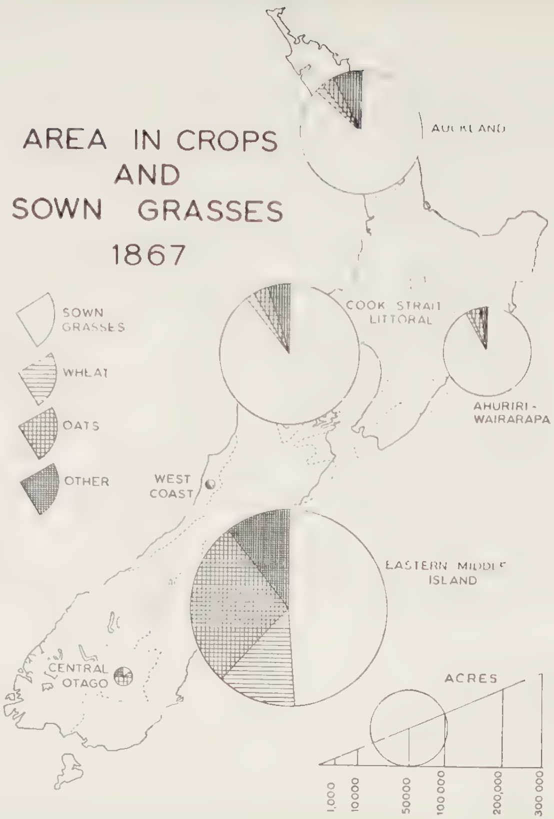
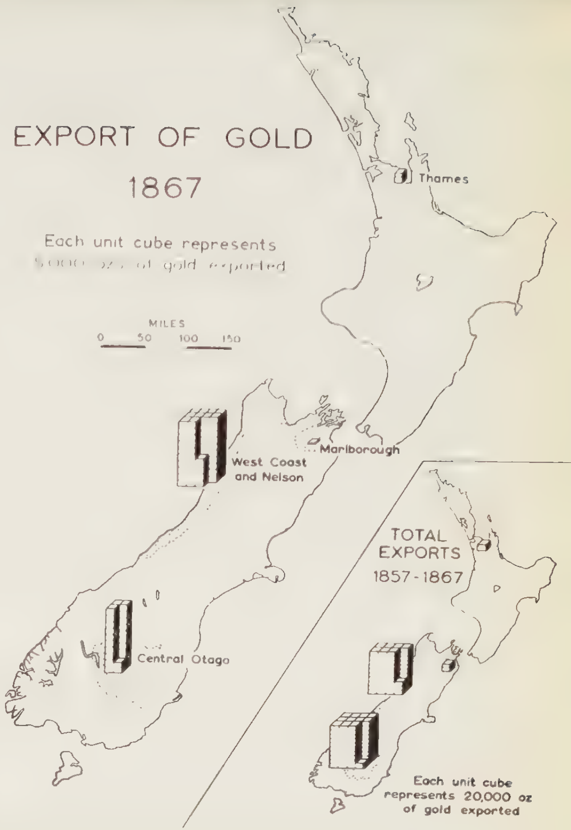
[16] *Hawke's Bay Herald*, Napier, 5 February 1867.

[17] *Weekly News*, Auckland, 23 February 1867; *Hawke's Bay Herald*, 29 January 1867; *Oamaru Times* quoted in *Hawke's Bay Times*, Napier, 31 January 1867.







Figs. 4, 5 and 6. Area in sown grasses, by provinces, 1858–1867; area in crops and sown grasses, by regions, 1867; and export of gold, 1867 grassland occupied more than eighty-five percent of all land which had been sown with exotic plants in that island.

The land was cleared by felling and firing, and charred stumps were a characteristic sight on the newly-created paddocks. Seed was sown broadcast on the ashes without any preliminary ploughing, although this might be resorted to after the first cropping. The entire area of a bush farm was rarely cleared at one time, but only that amount which could be successfully managed each year.

Whilst it was easy for visitors at the time, and for present-day observers, to comment adversely on the practice of bush burning, there was really little else which the settler could do. To him the majority of trees were of no value, for his greatest need was to obtain cleared land on which to grow food for himself and his family. Most bush farms were on the fringes of occupied land and the cost of transporting the timber over poor roads was so great that it was not a paying proposition. The settler's only alternative was to destroy it, and this was most quickly and cheaply done with a match.

Gold and the Goldrushes

The great goldrushes in Australia during the 1850's encouraged hopes that similar wealth would be found in New Zealand. As early as 1852 a minor rush had occurred to the Coromandel Peninsula, and five years later a similar rush to the Collingwood area of Massacre Bay (later renamed Coal Bay and then Golden Bay) had taken place, but in both cases they were short-lived and caused slight, and mainly local, excitement.

In May 1861 a major find was made by Gabriel Read, and almost immediately 'thousands of persons . . . despite storm and rain, in the middle of winter, along almost impassable roads, flocked towards the Eldorado' in the Tuapeka district of Otago. Soon there sprang up in Gabriel's Gully a 'tented town of not less than 600 tents . . . in a region hitherto wholly desolate'.[18] In August the first gold escort down from the diggings brought 5,056 ounces of gold to Dunedin. A year later two Californian prospectors, Hartley and Reilly, returned with 1,407 ounces of gold won on the banks of the Clutha in the Dunstan area.[19] Then in quick succession rushes occurred to the Arrow, the Shotover, Mt Ida and elsewhere, so that by 1867 mining was carried on in the extensive area contained by the Mataura River, Lake Wakatipu, the Hawkdun and Kakanui Mountains and by a line from Lake Wanaka to Tokomairiro.[20] Despite the fact that no major discoveries were made in the province after 1863, rich returns continued, engendering an optimism which prompted prominent men such as Vincent Pyke to claim that 'The Gold-fields are a permanent source of wealth in Otago'.[21]

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[18] F. von Hochstetter: *New Zealand*, Stuttgart, 1867, pp. 110–111.

[19] Vincent Pyke: *The Province of Otago*, Dunedin, 1868, pp. 21-22.

Just as the excitement resulting from the Otago discoveries was dying down, rich new finds of gold were made during the early months of 1865 on the heavily-forested, and then uninhabited, west coast of Canterbury Province. Despite disinterestedness on the part of some of the Canterbury settlers, the latter half of 1864 and early 1865 saw a major rush to the new bonanza.[22] Diggers explored all the creeks flowing into the Tasman Sea despite the isolation, the virgin bush and the dangers of frequent floods and swollen streams. The 'greenstone coast' of the Maori had become the 'gold coast' of the pakeha. As had been true in the first flush of discoveries in Central Otago, the prospector carried with him his tools of trade—the pick and shovel and the panning dish, and where necessary, constructed a sluice box and cradle.

Elsewhere in Nelson and Marlborough Provinces small fields were being worked, while in the North Island another rush had occurred to the Coromandel Peninsula, and 1867 witnessed the first returns from what was to prove a rich field, the Thames.

From the time of the Otago discoveries gold had been New Zealand's single most important export. In 1866 a record export of 735,376 ounces of gold was established, a record which will, it seems, stand for all time. The export from the various fields in 1867 was 686,905 ounces with the West Coast field providing the major share, although over the years 1857–1867 the greatest returns had been from Central Otago (*Fig.* 6).

Minerals other than gold were little mined. Coal discoveries had been reported in many parts of both islands, and here and there a little desultory mining was carried on from time to time. In 1867 coal was being produced at Kawakawa, Drury, near Nelson, Golden Bay, Malvern Hills, Greymouth and Shag Point. Among the problems confronting the efficient utilisation of the then-known coal resources were the considerable working expenses, the scarcity of labourers, and the poor transport facilities, but the major factor remained the settler's prejudice against the colonial product as compared with the imported coals to which they were accustomed.[23]

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[20] *ibid.*, p. 20.

[21] *loc. cit.*

[22] A leading article in the *Lyttelton Times*, 30 July 1864 stated: 'If a goldfield is, after all, to be forced upon Canterbury, without the consent and contrary to the expressed desire of the settlers, they must nevertheless submit to fate; and should the natural feelings of discontent, swelling up in their prudent bosoms when Fortune's golden favours are thrust into their hands, be somewhat hard to subdue, the consolation exists that the goldfield has turned up in the remotest corner of the province.'

Kauri timber remained an important export of the North Auckland and Coromandel peninsulas, even though at the same time timber was imported into New Zealand from overseas, particularly into Canterbury where timber was in short supply. Flax was a greatly-diminished export as compared with earlier days, and its decline was blamed on the Maoris who had ceased to hand-dress large quantities as had been their practice in previous decades. As yet no efficient machinery was commonly available to prepare the plant, and European labour was too expensive to continue to do it by the old method. The census reported only fifteen flax mills in the whole of the country, but this return was considered inaccurate, and the actual number was thought to be higher.[24]

Manufacturing in the Colony

Manufacturing in the 1860's was little developed and consisted primarily of the more simple kinds in which local raw materials were processed, primarily in the urban centres. Factories made flour, biscuits, jam, pickles, beer and ales, furniture, soap and candles, bricks and rope, and prepared hides by tanning. In Otago mining machinery was manufactured, while coach and boat building found expression in the larger towns of both islands.

An Expanding Population

An outstanding characteristic of the period, particularly from mid-1861, was the great increase in population which resulted in a large measure from the influx of miners from overseas. The colony's population rose from 32,500 in 1854 to 80,000 in 1860, and then zoomed spectacularly to the 1867 total of more than 218,000. The years 1861–1863 were those of greatest entry, the excess of immigration over emigration for that period being 72,333 persons.[25] The Middle Island recorded the greatest gain (Inset *Fig.* 7), its proportion of the total population rising from forty-three percent in 1858 to sixty-three percent in 1867. The increase in population in the different provinces varied (Inset *Fig.* 7). In Otago the great increase from 1858 to 1864 can be attributed primarily to the influx of miners to the Central Otago fields, while the slight decline over the following period reflects the exodus of gold seekers to the West Coast. The finds in the latter area account for the increases in Canterbury and Nelson during the previous few years. In the North Island the effect of the Maori Wars is most clearly reflected in the graph for Taranaki.

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[23] Hochstetter, *op. cit.*, p. 77.

[24] The number recorded was ten in the Auckland Province, three in Otago, and two in Southland.

Composition of the Population

As was characteristic of pioneering countries, especially those which also possessed goldfields, the proportion of females to males was low, being in 1867 in the ratio of 66 to 100. The population was also young, eighty-seven percent being below forty years of age, while half of these were under twenty-one.[26] The percentage of those born in New Zealand in the total population was only twenty-nine percent—a decline from the pregoldrush figure of 31.5 percent in 1858. The British Isles still provided the bulk of the population (fifty-nine percent), while the Australian-born had doubled from 2.4 percent to 5.2 percent.[27]

While population was still predominantly settled in the coastal areas, settlement had extended inland in the Middle Island (*Fig.* 7). Rural dwellers were in the majority with only thirty-seven percent of the European population living in towns of more than a thousand inhabitants. Some substantial stone and brick buildings were to be found in the urban centres, but the majority were constructed of wood, including wooden shingles for the roofing. Most streets were metalled with shingle or broken stone, and in the major centres the principal streets boasted paved gutters and raised footpaths, as well as gas lighting.

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[25] Robert Stout: *Notes on the Progress of New Zealand*, Wellington, 1886; *Statistics of New Zealand, 1867*, Part I, No. 1, and Part II, No. 3. The 1867 figure is exclusive of the military and their families, who totalled 1,455.

[26] *Statistics of New Zealand, 1867*, Part I, Census No. 1. For comparison, the sex ratio in 1956 was 99 females to 100 males (European population), while 64 percent of the population was below 40 years of age and 38 percent under 21.

[27] *ibid.*, Census No. 12.

The Maori Population

No accurate census of Maoris had been taken by 1867, and the *Statistics of New Zealand* for that year gives only an approximation of 38,154, with more than ninety-five percent living in the North Island.[28] In all probability actual numbers were higher, for there was little evidence on which to base the estimates made for the still hostile tribes who lived in the almost inaccessible interior of the North Island. The major areas of Maori settlement in 1867 are shown in Figure 8.

Despite the lack of accurate statistical data to support their contentions, most European observers felt at the time that the Maori were dying out. According to Hochstetter, many Maoris themselves considered this to be so and accepted it with fatalistic resignation, saying: 'As clover killed the fern, and the European dog the Maori dog; as the Maori rat was destroyed by the pakeha rat, so our people also will be gradually supplanted and destroyed by the Europeans'.[29] The decline, it was variously suggested, was due to disease plus the poor living conditions and deficient diet.[30]

In the towns of the North Island the Maori was a common sight, dressed in European clothes or in the blankets which had tended to replace the native flax mantle except in the more remote areas. In the European settlements the Maori sold kits of wheat, maize, kauri gum and other produce, and would return to his *pa* with European blankets, clothes, groceries, ironmongery and tobacco.

The usual *pa* housed from 50 to 200 people, and in nearby fields potatoes were the staple crop.[31] In areas like the Bay of Plenty extensive wheatfields were cultivated and there were occasional native-owned flour mills, but Maori cultivation had declined considerably from the previous decade.[32] A common characteristic of methods of cultivation by the Maori was the practice of never cropping the same piece of ground for more than a few years. Finding that the crops reduced the fertility of the soil, the Maoris abandoned the half-exhausted fields to

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[28] *ibid.*, Appendices B and C.

[29] Hochstetter: *op. cit.*, p. 222. See also Saunders: *op. cit.*, pp. 19 and 35; Charles Hursthouse: *New Zealand, the Britain of the South*, London, 1861, p. 113; Pusely: *op. cit.*, p. 252. The defeat in the Maori Wars and the loss of land by confiscation, as proclaimed by the New Zealand Government in 1867, further encouraged the feeling of hopelessness among the Maori people.

[30] William Colenso listed some thirteen suggested causes for the decline. See 'On the Maori Race of New Zealand', *Trans. & Proc. N.Z. Inst.*, Vol. 1, 1868, Wellington, 1875, pp. 417-418 (Second edition). Probably the first detailed discussion of the problem was in F. D. Fenton: *Observations on the State of the Aboriginal Inhabitants of New Zealand*, Auckland, 1859.

[31] Hursthouse, *op. cit.*, p. 119.

[32] Colenso estimated that Maori cultivations were not one eighth of their former extent (*op. cit.*, p. 414).

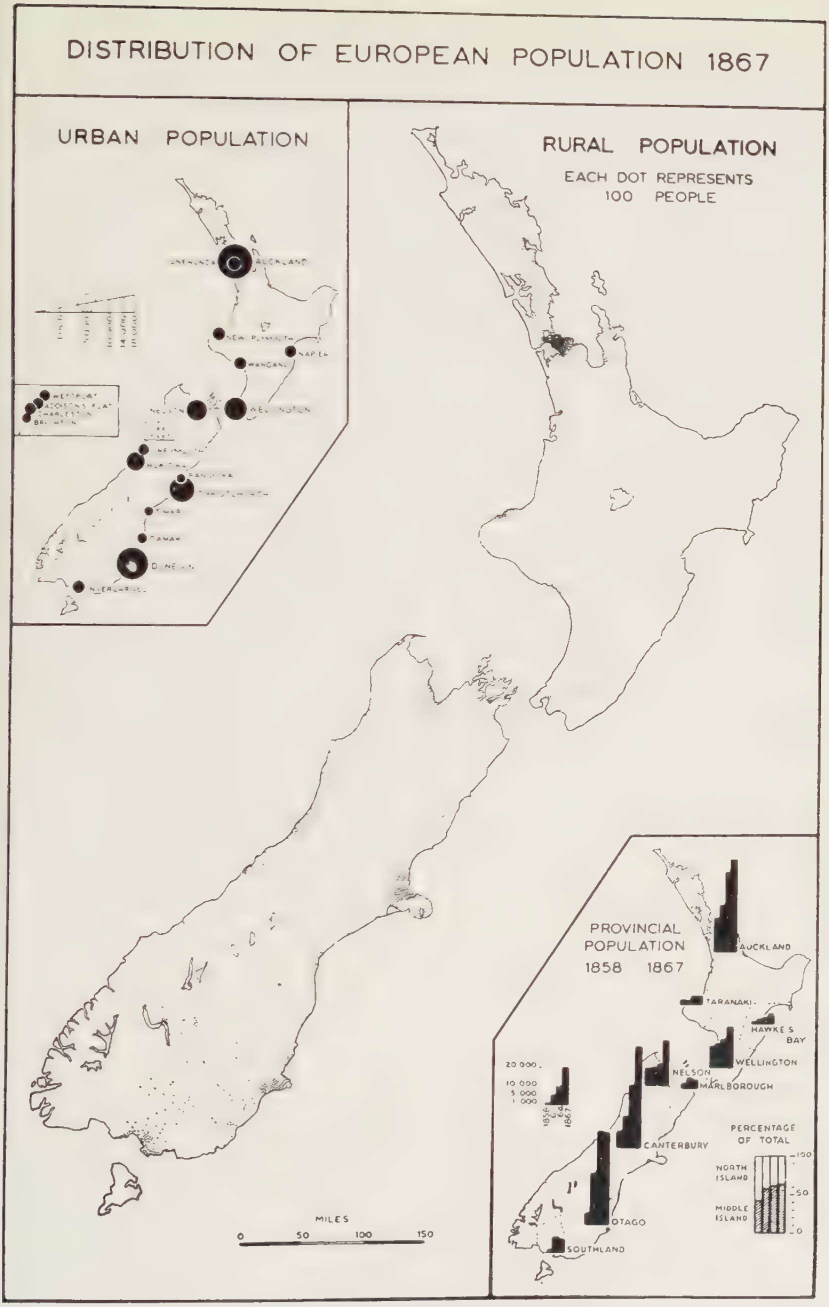

Fig. 7. Distribution of European population in 1867

fern and second growth and cleared and planted new areas.[33] Some tribes owned herds of cattle, and more rarely flocks of sheep, as did the natives of the Taupo area. Occupations other than farming in which the Maori engaged were flax gathering and gum digging, while near European settlements they worked for the settlers clearing bush, cutting firewood, fencing, harvesting, shearing and building roads.

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[33] J. E. Gorst: *The Maori King*, London, 1864, p. 109.

COMMUNICATIONS

Shipping was the major method of travel between the coastal settlements, particularly in the North Island. Besides sailing ships, both paddle and screw steam vessels were beginning to be used in local waters, and for overseas trips steamers were proving popular because of the shorter duration of their voyages. Thus Auckland to Sydney by steam took only five or six days, whereas by sailing ship the journey occupied double or triple the time.

Land communications, especially in the North Island, were on the whole still poor, although on the plains of Canterbury and Otago, roads were more numerous and better constructed thanks to the easier terrain and greater wealth of the provinces. Toll gates existed in a few localities, but proved a nuisance rather than a hindrance to communication. As yet only a few rivers were bridged and fording was necessary. In both islands only within a radius of fifteen to twenty miles round the main settlements were the roads regularly formed and metalled. After that the route followed rough tracks through the bush or across unenclosed grassland. In the North Island a good military road had been built from Auckland to the Waikato River, but most of the bush roads were merely rough cart tracks which became a sea of mud in wet weather. Here and there the beach served as a means of travel.

Regular coach services were to be found in many parts of the colony and in the Middle Island Cobb and Co. were making a name for themselves by the regularity and dependability of their services. Railways were unimportant and New Zealand could boast of only 46 miles of track in service in 1867. This was all in the Middle Island in two disconnected sections of different gauges.[34] The lines were Lyttelton–Christchurch–Selwyn with a gauge of five feet three inches, and Invercargill-Bluff with a gauge of four feet eight and a half inches.[35]

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[34] Strangely enough a Parliamentary Select Committee appointed to consider the question of a uniform gauge did not consider it was desirable at that time to insist upon uniformity. See 'Report of the Select Committee on a Uniform Gauge for Railways', *Append. Journ. House of Repres.*, (F-4), 1867, p. 3. However, three years later a Railways Act set a standard gauge of three feet six inches for the colony.

[35] Personal communication from the General Manager, N.Z. Railways.

Construction had begun on the line from Auckland to Drury, but by 1867 it had progressed but little. Telegraph lines joined the major centres of the Middle Island, and the recently-completed laying of a cable across Cook Strait had connected them with the seat of government.

Three alternative routes were available to and from England. The Suez and Panama routes involved trans-shipment and land travel over the respective isthmuses, but they were the quickest, taking between forty-five and sixty days, the Panama route being generally the faster. Less expensive, though more time-consuming, was the so-called 'long sea route' by which most immigrants came to New Zealand. This involved a journey lasting on an average at least one hundred days via the Cape of Good Hope. From New Zealand sailing vessels frequently returned to Europe via Cape Horn in order to continue to make use of the steady westerly winds of the southern latitudes. Frequent communication was maintained with the main Australian colonies, and contact was also kept with many other parts of the Pacific such as Tahiti, the islands of Polynesia, Peru, the East Indies, China and Japan.

The nine North Island ports handled only twenty-one percent of the oversea trade by value (*Fig.* 9). In the Middle Island seventeen ports were engaged in trading overseas, Dunedin–Port Chalmers, Hokitika and Lyttelton between them handling fifty-four percent of the New Zealand total. The dominant position of the West Coast ports was solely due to their exports of gold.

TRADE OVERSEAS

The trade of New Zealand was directed largely to two areas: the United Kingdom and the Australian colonies. By value these together took ninety-eight percent of the exports, the United Kingdom taking forty-three percent and the Australian colonies fifty-five percent. They also provided ninety-three percent of the imports of New Zealand, the United Kingdom accounting for fifty-two percent and the Australian colonies for forty-one percent.[36]

Minor trade was carried on with such widespread places as the United States, Mauritius, China, Chile, Norway and the South Sea Islands. Despite the enormous rise in the value of exports from £303,282 in 1853 to £1,644,678 in 1867 as a result of the gold discoveries and the expanding wool production, the great upsurge in

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[6] *Statistics of New Zealand, 1867*, Part II, Tables Nos. 14 and 15.

population numbers had resulted in a correspondingly increased demand for imports, the value of which rose from £597,827 to £5,344,607 over the same period. No year in the colony's history had yet seen the value of exports exceed that of imports.[37]

In addition to gold and wool, the other exports of New Zealand, equivalent to less than four percent of the total value, included kauri gum, grain and timber. Imports were more varied, with articles of food and drink (more than thirty-one percent by value) and clothing and drapery (more than twenty percent) the most significant.

Regional Geography: Auckland

In order better to understand the differences from place to place in New Zealand in 1867, eight geographic regions have been delimited, each displaying a personality of its own (*Fig.* 10).

The earliest European settlement occurred in northern New Zealand, but progress had not been great and only slowly were the frontiers of settlement pushing the forest back. To the south and east of the town of Auckland for some ten miles occupied land was more or less continuous, but on the peninsula to the north, and in the Waikato to the south, settlements were small and scattered. The region was thus characterised by a number of agricultural communities with small mixed farms carved out of the forest—Albertland, Waipu, Whangarei, Bay of Islands, Hokianga, Whangaroa, Mangonui, Papakura, Drury and Waiuku.

The large-scale growing of crops was unimportant (*Fig.* 5) for the farmers could not compete with the more favoured agriculturists of the eastern Middle Island. Wheat, oats, maize and potatoes were grown in limited quantities, but the major emphasis was on running cattle on the newly-laid English grasses, the seed of which had often been sown directly on the ashes after a bush-burn and rudely harrowed in. Manure or fertiliser was only occasionally applied, although farmers who had experimented with bonedust had found the productivity of their croplands had increased as a result.[38] Only after pastures were established could sheep be kept, for they could not survive on bush feed like cattle. Farms were on the whole small, varying from 5 to 100 acres although in an occasional instance farms of more than a thousand acres were to be found.

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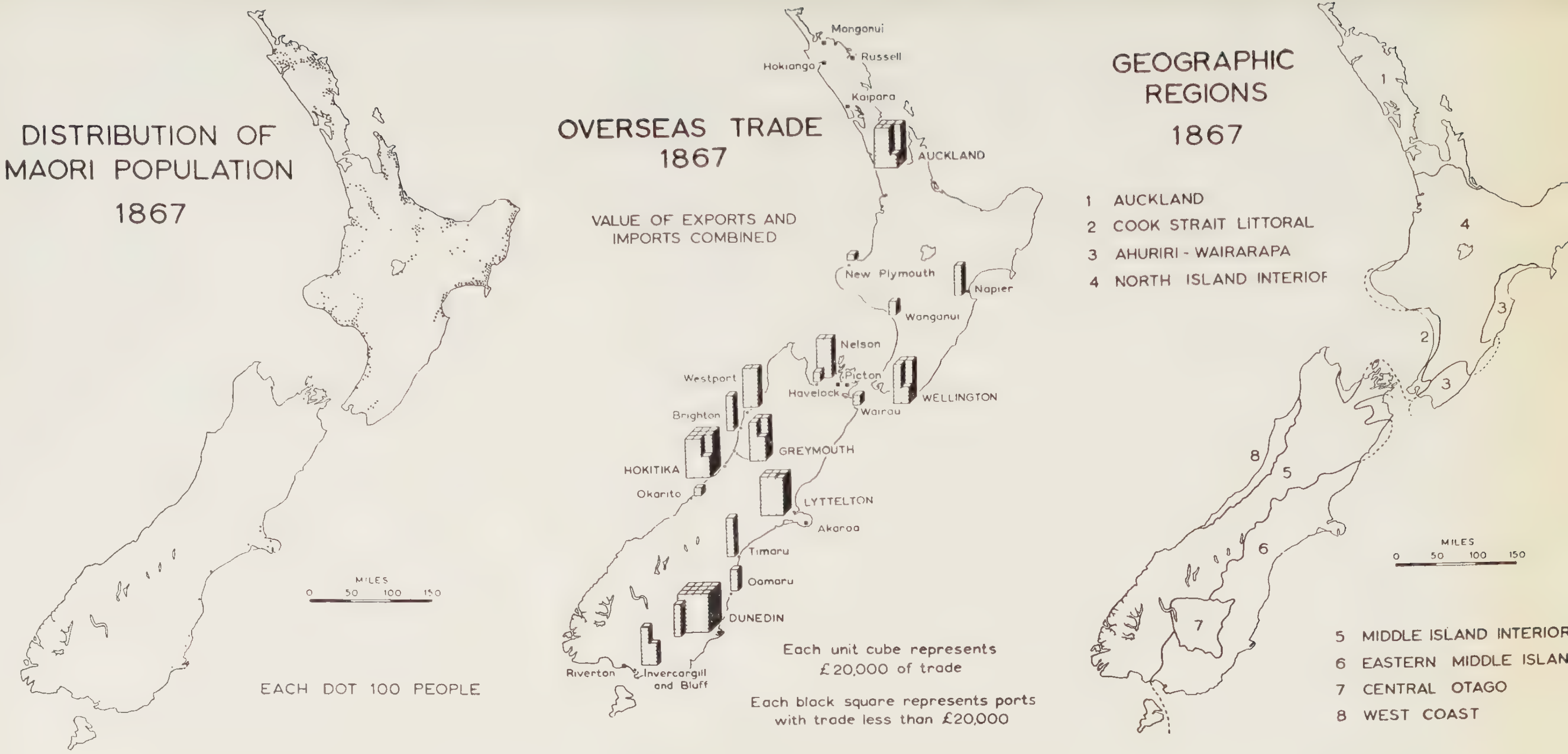
[37] The only year between 1853 and 1887 when export values exceeded import values was 1871.

[38] *Daily Southern Cross*, Auckland, 16 February 1867, p.5; *N.Z. Herald*, Auckland, quoted in *Hawke's Bay Times*, 10 January 1867.



Figs. 8, 9 and 10. Maori population, trade overseas and geographic regions in 1867

Farming remained semisubsistence in most areas because of the poor communications, for on land the bush tracks and primitive roads were often impassable. For most of the settlements contact with one another was most easily achieved by sea, and even the most distant community was less than thirty hours away from Auckland by this mode of transport.[39]

On the southern margin of the region, settlement remained at a standstill because of the fear of further depredations by the Maoris. Here and there little knots of white men carried on trade with the natives, milled the bush, or squatted on small farms, but the maintenance of their livelihood was always tenuous. Settlement on confiscated Maori land at Pirongia, Te Awamutu, Hamilton, Cambridge and Tauranga had been made by soldiers who, it was hoped, would prove a bridgehead against any further native attacks on settlements in the Waikato. In the region itself the Maori population was numerous (*Fig.* 8) and provided labour for many European activities.

In 1867 the only area in the region which showed any booming measure of economic activity was the new goldfield at the Thames. The quartz deposits here sprang into prominence in the closing months of the year, miners flocked to the area, and gold exports jumped from 199 ounces in August to over 2,867 ounces by December. The town of Shortland (Thames) with its northern suburb of Grahamstown, had sprung up on the low-lying flat at the mouth of the Waihou River, and soon this shanty town was infamous for its mud. Observers complained that 'you cannot walk along the streets without danger of being swamped'.[40] On the hills behind the town numerous shafts had been driven which gave the slopes the appearance of being an immense rabbit warren.

In the bush of the North Auckland and Coromandel Peninsulas the occupations of timber milling and gum digging were still followed. The major areas of kauri milling were along the banks of the Wairoa River, on the shores of the Kaipara and Coromandel Harbours, and at Mercury Bay. Gum digging was practised spasmodically throughout the region and returns fluctuated from year to year, though over the past six years there had been a general rise in exports.[41]

European population numbered more than 43,000, or one fifth of the total of the colony. The region was dominated by the town of Auckland which, with its suburbs of Parnell and Newton, had a population of approximately 17,000. Served by both the Waitemata and Manukau Harbours, the town boasted of its commanding mercantile position. Talk of cutting a canal between the two bodies of water had resulted in Auckland's describing itself as the 'Corinth of the South'. The town was proud of its streets newly-lit by gas, but was still smarting under the humiliation of having lost the position of colonial capital to Wellington some three years previously, although it still retained the headquarters of the military and the missions.

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[39] Hursthouse, *op. cit.*, p. 130.

[40] *The Thames Miner's Guide*, Auckland, 1868, p. 69.

[41] Kauri gum exports in 1861 were 856 tons; in 1862, 1,103 tons; in 1863, 1,400 tons; in 1865, 1,867 tons; in 1866, 2,535 tons; and in 1867, 2,685 tons (*Handbook of N.Z. Mines*, p. 386).

Fig. 11. A farm newly cleared from the bush in the North Island
(*Photo:* Turnbull Library)

Across the Waitemata Harbour on the North Shore an almost self-contained township had grown up which was connected with Auckland by a regularly-scheduled steam ferry. On the isthmus were the former pensioner villages of Onehunga, Otahuhu, Panmure and Howick, all of which were surrounded by small 'garden-farms' of a few acres which supplied Auckland with fresh vegetables, fruit, butter, cheese, poultry and grain. Over the whole isthmus practically all traces of the former native vegetation had disappeared and had been supplanted by European domesticated plants, while cottages and farms, surrounded by stone walls and hedges, dotted the landscape.

Cook Strait Littoral

With sixteen percent of the European population, this region, areally concentrated along the coast and hemmed in by forest and often hostile Maoris, was centred on the original New Zealand Company towns of Wellington, Nelson, New Plymouth and Wanganui, none of which held a dominant position as did Auckland in its region. Limited in the land immediately available for settlement and vitally concerned with the native problem, this region showed little advancement in the 1860's. As in the other settled North Island regions nine-tenths of the cropped land had been planted to English grasses (*Fig.* 5), and small mixed farms were typical.

Taranaki, long known as the 'Garden of New Zealand', had suffered grievously from the fighting between the two races and many farms had been abandoned, so that by 1867 only the immediate environs of New Plymouth were farmed. Dairying was specialised in, and the area was famous for its Devonshire cream. New Plymouth itself was struggling to maintain its existence, and in this was hindered by the lack of a harbour or wharf, all goods and people having to be transshipped by small boats. Contemporary town maps show a relatively large town with numerous streets running parallel with one another. These maps were deceiving, for as one visitor reported. 'not one quarter of the streets are filled, and those which are partially so and those which are not have an equally disreputable and bankrupt appearance. The houses are all of wood, of a very primitive style of architecture, with zinc chimneys; they are unpainted, more than half untenanted, and going rapidly to decay'.[42]

The coastal area of Wanganui–Manawatu had also marked time as a result of the Maori Wars, and the once considerable native trade engaged in by Wanganui had dwindled away. Sheep were more important here than elsewhere in the region, and much of the fern land after being burnt, ploughed and put into pasture without benefit of cropping with potatoes or grain, would carry four or more sheep to the acre.

Wellington, the new capital, had its central position to thank for its importance in political affairs. Hedged in by hills, its small area of more level land was at a premium, and this state of affairs was reflected in the land reclamation which had been undertaken between 1857 and 1863, as well as in the number of narrow streets and lanes which were typical of the town. No agriculture was carried on areas contiguous to the settlement, but the valley of the Hutt some eight miles distant provided some of the necessary farm products. Further supplies were obtained from Porirua and other small village settlements along the coast towards Wanganui.

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[42] *Daily Southern Cross*, 23 January 1867.

Although in the Middle Island, Nelson had more and closer contacts with Wellington, Wanganui and New Plymouth than any other Middle Island centre. Farms here were characteristically small and devoted to mixed farming, as were the rest of the holdings in the region, and for these two reasons it is included within the Cook Strait littoral. A specialised crop of Nelson was hops, which were claimed by many to be superior to any imported from England. The town of Nelson, with a population of 5,652, dominated by its cathedral church set among white wooden houses, and with its profusion of fruit trees and English shrubs, had a restful atmosphere which appealed to many a visitor and the town was considered to be the 'Sleepy Hollow' of New Zealand.

AHURIRI–WAIRARAPA

In the North Island only in this region was farming focused on extensive grazing of livestock, and here were to be found two-thirds of the island's sheep. Utilising the areas of open land which in the days of first settlement had been covered with fern or scrub, large stations had been formed. The fern hills had been burnt off and surface sowing resorted to in order to establish a pasture, although on some runs the sheep existed for a time on the natural growth which followed the firing. Ninety-two percent of the sown land was planted to English grasses, and this proportion was higher than in any other region (*Fig.* 5). Thus only a very small area was utilised to grow crops, and of this area more than two-thirds was in oats for feed. The region was forced to import wheat and other farm produce, and the need for small agricultural farms was a common subject for discussion.[43]

A problem of the time was the alarming spread of the Scotch thistle, particularly in the Ahuriri district where it grew unchecked on native-owned land, and acted as a deterrent to any extension of European small farming.[44]

Napier, the main settlement, with a population of 1,827, lacked port

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[43] For example see *Hawke's Bay Times*, 16 December 1867.

[44] *Hawke's Bay Herald*, 3 March 1866.

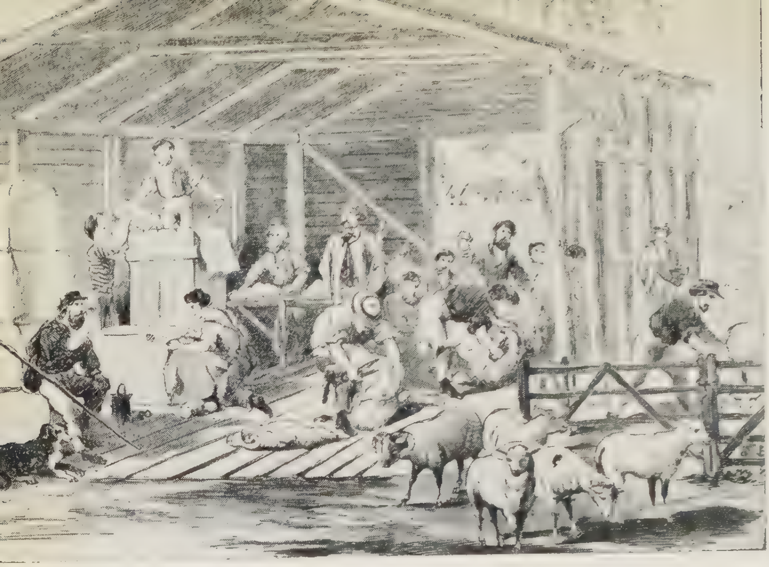

Fig. 12. Shearing shed of the 1860's

Photo: Turnbull Library

facilities available in all weathers, and passengers and freight had to be transported by small boats to the vessels lying in the open roadstead. In the Wairarapa no single town was dominant, for only small centres such as Greytown, Masterton, Featherston and Carterton existed. On the whole, the region was sparsely populated by Europeans, there being only four percent of the total in the colony.

NORTH ISLAND INTERIOR

Although constituting approximately two-thirds of the area of the North Island, European penetration was negligible, and the region had less than two percent of the non-native population of New Zealand. On the other hand it remained the domain of the Maori who, aided by the thick bush which clothed most of the region, had successfully prevented pakeha occupation, and here was centred the resistance to the white man. Only here and there existed small European outposts, such as Raglan, Te Awamutu and Opotiki, still attempting to fulfil their function as a mission or trade centre or as a military base.

Economically the region contributed little to New Zealand, for Maori agriculture, having declined considerably from its heyday of the previous decade, no longer furnished vast quantities of potatoes, wheat, onions, maize and pork to the settlers of Auckland. The cultivation of these crops was still maintained but the produce was sufficient only as a bare subsistence for the tribes. An exception to this was the Taupo tribe who, remaining at peace throughout the 1860's, continued to run a large flock of sheep and to grow crops.

Middle Island Interior

This region of high snowcapped peaks, fringed on the western littoral by heavy rainforest, was practically devoid of all settlement. Although crossed only by a single road through Arthurs Pass, the region had nevertheless been traversed in its southern extent on numerous occasions by prospectors hopefully searching for a rich new strike of gold. Exploratory expeditions from Otago had been made across the mountain barrier to Martins and Jackson Bays, and high hopes were held for successfully forming settlements in these two locations at some future date. However, few people expected any great extension of settlement within this alpine region.

Stewart Island remained clothed in bush, and only a few sawmills, such as the ones at Pattersons Inlet, were in operation milling predominantly rimu timber. The population of the island consisted of a few score people, chiefly old whalers and half-castes.[45] Whaling and sealing activities from shore stations along Foveaux Strait had almost entirely disappeared. The region, with its mountains and fiords not yet regarded as a tourist attraction, remained for most New Zealanders a neglected and unknown region of little value or apparent potential.

Eastern Middle Island

This region, which embraced more than forty percent of the population of New Zealand, was by far the most advanced in political and economic development, and because the Otago and Canterbury Provincial Governments were relatively wealthy, public works had been pushed on with greater vigour than elsewhere. Extensive pastoralism was the major economic activity, and from Cook Strait to Foveaux Strait, from the Pacific Ocean to the snowline of the Southern Alps the natural grasslands had been occupied and divided into sheep-runs of 10,000 to 100,000 acres, carrying one sheep to about two acres.[46]

The majority of the runholders, or 'squatters', were of Australian origin, and only leased most of their land from the government. Even though wire fencing had been introduced, as yet few of the sheep stations had any internal subdivision, and many in the more remote parts were unseparated from their neighbours other than by such natural boundaries as rivers. Trees and hedges were uncommon features in the sheep country, so that it appeared to many as monotonous and ugly. The Earl of Lyttelton, straight from the mature landscape of England, described his impression of the Canterbury Plains:

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[45] *Southern Provinces Almanac; Directory and Yearbook for 1865*, Christchurch, 1864, p. 63.

> Looking narrowly across these vast plains, you see a few sheep wandering about; the few homesteads at wide intervals, like oases in the desert, marked by the small buildings and the trees growing up around them; a few enclosures with clay banks, on which scanty gorse is growing; mud cottages here and there, where the shepherds live; a few cornricks scattered about; some almost invisible wire fences, dividing properties; and sometimes a slow-moving wool waggon crawling across the plain.[47]

The lack of trees was a problem for runholders, for not only was shelter desirable against the winds which swept the plains, but wood was also in demand as fuel since the solution of tobacco water used for dipping sheep had to be heated to a temperature of not less than 90°.[48] This absence of trees was not true of all districts in the region, as for example in the southeast where the 'Great Tautuku Bush' stretched from the Nuggets to Waikawa, although the area was little used for farming.

The gold discoveries in Australia and New Zealand had resulted in a growing demand for grain and other agricultural produce. In response, there had developed along the coastal fringe of the Canterbury Plains, on the Taieri Plain, and on the plains surrounding Invercargill, areas of closer-settled land occupied for agriculture and the grazing of fat stock and dairy cattle. Relations between the squatters and the small farmers, or 'cockatoos' as they were known,[49] were never friendly, for the latter were slowly pushing the former back from the good land near the settlements by buying the freehold of the hitherto leased land. The tussock was ploughed under and grain and English pasture planted in its stead.

In 1867 this region constituted the granary of New Zealand, having over four-fifths of the grain acreage and providing eighty-three percent of the 131,915 bushels of wheat exported.[50] Some forty-five percent

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[46] Hursthouse, *op. cit.*, p. 60.

[47] Earl of Lyttelton: *Two Lectures on a Visit to the Canterbury Colony in 1867–68*, Stourbridge, 1868, p. 27.

[48] Butler, *op. cit.*, p. 43.

[49] The term 'cockatoo' was later shortened into 'cocky', the familiar New Zealand slang for farmer.

[50] Wheat exports fluctuated and were dependent on oversea and New Zealand demands and 1867 saw the highest export for a number of years. In 1855 a peak export of 92,499 bushels was sent overseas, almost solely to the Australian colonies. Demand slackened off, and in 1860 only 11,168 bushels were exported. During the next six years the great demand within New Zealand meant little was available to be sent overseas (*Statistics of New Zealand, 1867*, Part II, Table No. 22).

Fig. 13. Wanganui from St Johns Hill in the 1860's, with Rutland Stockade in the centre background. Unrest and uncertainty were restricting the growth of the town

Fig. 14. Dunedin in 1867 was the foremost town of New Zealand, and was the commercial and financial capital. This view is down MacLaggan Street

Fig. 15. In Central Otago boom towns had arisen, and Lawrence had all the air of impermanency and heterogeneity of gold-mining towns, though it was to persist

of the planted land of the region was in oats (twenty-eight percent), wheat (thirteen percent), or other grains (four percent). (See Figure 5.) The average yield of wheat per acre in New Zealand was estimated to be 20 to 25 bushels, but as this included all areas of lower yields in the climatically less favourable North Island, the yield in the Eastern Middle Island would have been higher despite the fact that no fertilisers were used.[51]

The high cost and shortage of labour was a hindrance to an even more rapid expansion of grain acreage, for much of the crop was still sown by hand and harvested with a sickle or reaping hook, but a beginning had been made in introducing machinery then in use in England and North America. A few drills for planting, some simple harvesting machinery, and the first use of steam power in threshing were signs of a coming revolution in methods which were to transform the face of the region over the next two decades. A great increase in acreage, plus falling prices in 1867, forced the grain merchant to look outside New Zealand and Australia for a market, and that year saw the first export of wheat from Canterbury to England.[52]

Dunedin and Christchurch were the largest towns of the region, and by 1867 had so grown that the original clear-cut characteristics associated with their founding had become blurred, and no longer was the former overwhelmingly Presbyterian nor the latter exclusively Anglican in religion. Dunedin, with a population of more than 17,000, was the commercial and financial capital of New Zealand. Some seven years before it had been a small struggling village of about 2,000 inhabitants with paved or metalled streets so rare that her muddy thoroughfares had earned for the settlement the nickname 'Mud-Edin'.[53] Following the gold discoveries Dunedin expanded almost overnight, good roads were constructed and substantial and often ostentatious buildings erected. Houses of three and four storeys were not uncommon, although elsewhere in New Zealand they scarcely ever exceeded two storeys.[54] Manufacturing, especially of mining equipment, had developed to a greater extent than in other New Zealand towns. Water connection with Port Chalmers was being improved by the dredging of the channel in the Otago Harbour, and the port was one of the busiest in the colony, being as it was the major gateway to the Central Otago goldfields. A feature unique to Dunedin was the presence of Chinese hawkers who sold fruit and vegetables round the city streets, carrying their wares in baskets slung on a long pole carried across their shoulders. Much of the produce had been grown by themselves on small recently-acquired, intensively-worked holdings situated on the Taieri Plain or on sheltered bays along the harbour.

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[51] Hursthouse: *op. cit.*, p. 205.
[52] *The Southern Provinces Almanac; Directory and Yearbook for 1868*, Christchurch, 1867, p. 127.
[53] Alfred H. Duncan: *The Wakatipians*, London, 1888, p. 3.
[54] Mrs. Charles Thomson: *Twelve Years in Canterbury, New Zealand*, London, [1867], p. 32.

Christchurch, with a population of about 7,000, proclaimed its church origin by the naming of its streets after English sees and bishops, and by the focus of the town on the Square where it was hoped that one day a cathedral would dominate the scene. The foundations for this had been laid, but construction had been halted because of lack of funds. This, plus the great variety in the architectural style of the town's buildings, had caused one visitor to describe Christchurch as having 'an unfinished and untidy appearance'.[55] However, the tunnel through the Port Hills had at last been completed, and Christchurch and its port of Lyttelton were connected by rail instead of a steep, twisting road.

Other towns in the region such as Picton, Kaiapoi, Akaroa, Timaru, Oamaru, Port Molyneux, Milton and Invercargill were relatively small communities serving the surrounding farming areas. Land communications in the region were frequent and efficient, and here were the only lengths of railway line in New Zealand. Cobb and Co. ran regular coach services between the main towns, including a new service from Christchurch to Hokitika via the recently-completed road across Arthurs Pass and through the Otira Gorge. The four-horse coach ran twice weekly each way and covered the distance in thirty-six hours, including a twelve-hour overnight stop at the halfway station.[56]

CENTRAL OTAGO

This region was a major area of gold mining. Here, unlike the West Coast, sparse settlement had already taken place before the arrival of the diggers, for the area had been taken up for sheep runs in the late 1850's. After 1861 numerous small towns such as Lawrence, Roxburgh, Alexandra, Clyde, Cromwell, Naseby, Arrowtown and Queenstown had sprung up. These towns varied in size, not only from one another, but also from month to month depending on whether the local gold diggings were booming or declining. They had an atmosphere of impermanency, attributable in part to the roughly-built mud and stone houses, and a characteristic feature was the abundance of hotels and grogshops. This region had the distinction of being the first inland area to be settled in numbers, and had three percent of the population of New Zealand.

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[55] 'A Sketch of Canterbury, New Zealand', *Parish Magazine*, [London?], No. 7, 1868, p. 17.

[56] Hochstetter: *op. cit.*, p. 512.

In 1867 the most widely-practised method of obtaining gold was by sluicing the river banks, terraces and hillsides. Races wound their way round the slopes carrying the necessary and precious water to the claims, which now tended to be worked by companies or by a number of diggers in cooperation rather than individually as had been true in the first flush of discoveries. One correspondent on the goldfields went so far as to describe 'the cradleman and solitary "hatter" ' as 'those almost obsolete individuals'.[57] On the Clutha River primitive spoon dredges employing six to eight hands were used to scoop up the 'golden sand' from the river bottom. The Chinese prospector was frequently to be seen in Central Otago in 1867, whereas in the other goldmining area of the West Coast he had not yet made his appearance in any numbers.

Despite the early recognition of the existence of quartz reefs, only spasmodic attempts at working them had been made, for the alluvial fields were too accessible for miners to consider settling to the harder quartz mining. Combined with this was the need for capital to work the reefs, the high rate of wages demanded, and the difficulty and expense of procuring and transporting the necessary machinery and timber to Central Otago.

In the short time the diggers had been in the region the landscape in limited areas had been changed. Sluicing had already resulted in the wasting and destruction of the soil where mining had occurred, and piles of stones became the familiar symbol of this act. Despite the apparent plentiful supply of water, if the numerous races were taken as evidence, it was often in short supply and was always a problem in this dry interior where rainfall is often less than twenty inches per annum.

While many miners left Central Otago to try their luck at the new diggings on the West Coast, many others remained, and several had taken up small areas of up to fifty acres for farming, either as a full-time occupation or as a sideline to occasional prospecting. Around Clyde the forerunners of the many fruit orchards to be found in Central Otago today had been planted.

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[57] *Otago Daily Times*, Dunedin, 2 July 1867, p. 5.

Fig. 16.
Stafford,
a West Coast
mining town

Photo:
Turnbull
Library

The sheep runs in the region were similar in every respect to those found in the neighbouring Eastern Middle Island region. Rabbits had been released in several localities in both regions but had not yet become the scourge they were to prove within a short time, although prophetic voices were being raised in warning.[58] On the contrary, the rabbit was generally welcomed as an additional source of food by the mining and farming population.

THE WEST COAST

This was the most dynamic region in 1867, its development and settlement by Europeans being of less than four years' duration. In mid-1864 gold in rich quantities had been discovered in this hitherto uninhabited area, and as a result prospectors poured in, first from Otago and the other provinces, and then from overseas. In less than a year some 3,000 miners were reported to be at work within twenty miles of Hokitika alone.[59] Mushroom towns sprang up overnight filled with jerry-built shanties. Besides these miners' shacks each town had its quota of shops, banks, public houses, hotels, billiard saloons and other places of amusement. In 1866 Charleston, with a fluctuating population of between one and two thousand, boasted at least eighty hotels.[60]

Hokitika was the largest town, for here was the most useful harbour, despite the dangerous bar at the river mouth which had caused so many wrecks that crossing it was known at the time as 'running the blockade'. Archdeacon Harper gave a vivid description of Hokitika as he first saw it in the latter months of 1866. From the sea it appeared as

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[58] See the report of a meeting of the Acclimatisation Society Council, *Otago Daily Times*, 2 August 1867, p. 5.

[59] Hochstetter: *op. cit.*, p. 116.

[60] *loc. cit.*

> a clearing in the forest, with wooden buildings, tents and corrugated iron structures, which form the metropolis of the new El Dorado . . . . One long narrow street, over a mile in length, of wooden houses, built right on the sandy beach, just clear of huge trees, some fallen; its suburbs a wilderness of gigantic stumps; crowds of men, rough and ready; their talk of gold, deep and shallow sinking, new rushes, water races and sluicing. Eighty so-called hotels in one street, strings of pack horses heavily laden; no vehicles, for there are only narrow paths through the forest; a few coaches which run up and down the beaches.[61]

The population of the region probably numbered more than 30,000—fourteen percent of the colonial total—with males outnumbering females four to one, for this was a harsh rough area where life was difficult and dangerous.[62] The population was spread along the coast for some 180 miles, for gold was not found in one single deposit but was to be won in almost every creek which debouched from the thick rainforest into the waters of the Tasman Sea. The Greenstone, Waimea, Kanieri, Hokitika, Totara, Mikonui and dozens of then nameless streams all had their clusters of diggers. Prospecting was difficult and travel arduous for roads existed in only a few favoured spots, and consequently most north-south travel was along the beaches. Communications with areas outside the region were mainly by sea despite the opening of the road across the Southern Alps to Christchurch. Practically all food was imported and stock was driven overland from the Canterbury Plains.[63]

CONCLUSION

New Zealand in 1867, then, was a land of contrasts between the two islands. As for the future, destiny seemed to lie with the Middle Island, and the next decade was to see the development there of bonanza wheat farms which still further enhanced its ascendancy, while in the North Island farming and settlement was still to lag despite the blessings of peace.

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[61] Henry W. Harper: *Letters From New Zealand*, London, 1914, p. 92. This picture, with slight variations, could be applied to most of the gold towns of the West Coast in the period under discussion.

[62] The population figure is only a rough estimate. The census of 1867 itself recognised the difficulty and hopelessness of trying to give an accurate picture. For an interesting discussion of the population of this region see Murray McCaskill: 'The Goldrush Population of Westland', *N.Z. Geographer*, Vol. 12, No. 1, April 1956, pp. 32-50.

[63] *The Press* regularly published statistics of the stock driven past the Rangiriri Police Station on its way to Hokitika. For example, for the week ending 26 December 1866, 120 cattle and 800 sheep had passed on their way to the West Coast (*The Press*, 1 January 1867).

VILLAGE AGRICULTURE IN VITI LEVU, FIJI*

R. GERARD WARD

AGRICULTURE is of paramount importance in the economy of Fiji. In terms of value, agricultural products have contributed over seventy percent of Fiji's exports in recent years.[1] In terms of employment, 52.9 percent of all adult males were engaged in agriculture in 1956.[2] In the same year the Fijian component accounted for 42.8 percent of the total population and for 46.2 percent of all males engaged in agriculture,[3] and Fijians held almost eighty-five percent of the land of the colony. Recent estimates by the Department of Agriculture show that Fijians farm 48.3 percent of all the land used for agricultural and pastoral purposes.[4] As almost eighty-five percent of all Fijian farmers are engaged in 'village agriculture' the importance of this aspect of the economy is obvious.

For the purpose of this paper, 'village agriculture' is defined as agriculture practised by persons dwelling in a village community, taking part in communal duties, and using land to which no individual title is held. This definition eliminates those Fijians who are exempt from communal duties and who work as independent farmers (*galala*) on either communal or leasehold land.

Within the broad category of village agriculture there is wide variety from one village to another—in the crops grown, in the techniques used, in the areas involved, and in the importance of agriculture (and particularly of cash cropping) to the economy of the village. This variety stems from many factors but is often closely related to the general modification taking place in the Fijian way of life under the influence of contact with Europeans and Indians. This process of change has been going on continuously since the first contacts between Europeans and Fijians were made one and a half centuries ago, but there have been two periods of particularly rapid change. Between 1860 and 1880 there were greatly increased contacts between Fijians and Europeans, and most of the permanent alienation of Fijian land took place in the fifteen years prior to 1874. In that year Fiji was ceded to Britain and the alienation of native land was prohibited. With the establishment of peace consequent upon British rule, a considerable change took place in the location of village settlements and in the form of village agriculture. After about 1880 the rate of change was slowed by the various regulations aimed at the maintenance of the village system and at the prevention of permanent land alienation.

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*This paper is part of a wider study of population and land use in Fiji. Preliminary fieldwork was carried out in early 1958, and thanks for financial assistance are due to the University of New Zealand Carnegie Social Science Research Committee. Grateful acknowledgement is also made of the valuable assistance and information provided by many persons, officers of the Fiji administration and private individuals. A shorter version of this paper was read at the Adelaide conference of the Australian and New Zealand Association for the Advancement of Science, August 1958.

[1] *Fiji Information*, August 1959, p. 5.

[2] N. McArthur: *Report on the Census of the Population 1956*, [Fiji] Legislative Council Paper No. 1 of 1958, Suva, 1958, p. 43.

[3] *ibid.* Unless otherwise stated, all population statistics for 1956 are taken from this source.

[4] A. C. S. Wright and I. G. Twyford: *The Soil Resources of Fiji* (in the press). This figure was arrived at by multiplying the actual area under bananas and root crops by seven so as to allow for fallow areas and then adding the area in pasture, sugar cane, tree and other crops.

EFFECT OF THE WAR

The second period of accelerated change was initiated during the second World War.[5] In this second period the impact on the village landscape has been less marked than in the first. The aspects of village life which have been most influenced in recent years, however, are closely linked with the basic attitudes of the people towards their traditional forms of economic and social organisation. As a result, the long-term effects of this second era of change are likely to be more far-reaching than the effects of the first. Service in the armed forces, the presence of large numbers of United States and New Zealand troops in the colony, and new opportunities for earning money were among the initial agents of change. After the cessation of hostilities many of those who had been away returned to village life with some reluctance, and more and more persons sought exemption from it. Since the war new opportunities for employment have arisen in the towns, and in some areas increasing population has created local land shortages. These and the general attractions of an individualist life have helped to promote the movement of population away from the villages—a movement made all the easier by improved communications.[6] At the same time the growing population of Fiji has made more important than ever the economic contribution which could be made by Fijians cultivating their own land. That the administration is aware of these trends is indicated by the fact that it has instigated

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[5] See W. R. Geddes: 'Acceleration of Social Change in a Fijian Community', *Oceania*, Vol. 16, No. 1, September 1956, pp. 1-14.

[6] See R. G. Ward: 'The Population of Fiji', *Geog. Rev.* Vol. 44, No. 3, July 1959, pp. 322-341.

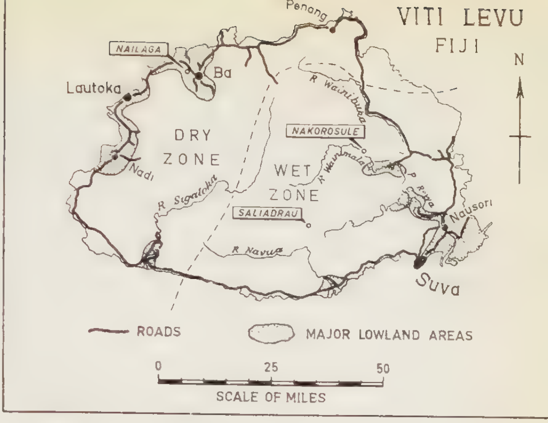

Fig. 1. Viti Levu, Fiji—Main lowland areas, wet and dry zones, and location of sample villages

enquiries into the economic problems and prospects of the Fijians and into the resources of the colony as a whole.[7]

Different parts of the group have progressed different distances along the path of changing agricultural patterns. The aim of this paper is to discuss briefly the 'traditional' form of village agriculture and the associated systems of land tenure, and then to describe three present-day villages chosen to illustrate different stages in the process of change. Figure 1 shows the location of the sample villages.

The Setting

The greater part of Viti Levu, the largest island of the Fiji Group, consists of broken hill country. Much of the area is extremely steep, and flat land, or even moderately-sloping land, is limited in extent and is confined to the narrow alluvial flats along the major rivers and to the plains near their mouths. It has been estimated that largely owing to steep slopes and poor soils, only 28.7 percent of the total area of Viti Levu is potentially useful for arable purposes, orchard crops or grazing.[8] The coastal areas and major plains are served by roads, but the rivers are the highways of the interior, and many parts of the island are accessible only on foot. The degree of accessibility is a major factor in accounting for the present character of agriculture in any village.

In the dry zone of Viti Levu (*Fig.* 1) rainfall is between sixty-five and eighty inches in coastal areas compared with 125 inches in the southeast of the wet zone. In both zones there is a drier period from June through August or September, but whereas in the wet zone all months have more than five inches of rainfall, in the dry zone up to four months of the year usually have less than three inches. In these conditions irrigation would be necessary in the dry zone to obtain maximum production for crops such as bananas or taro. The long periods of drought or semidrought in the dry zone have favoured the removal by fire of the forest which must have originally clad most of the island. The destruction of the vegetation by fire still continues and is a serious problem in the dry zone, which now has a predominant vegetation cover of grass or hard fern with scattered trees. Patches of forest remain on some of the heights, while the valley bottoms and shady southern slopes frequently have a cover of scrub. Villagers in the dry zone often locate their food gardens in these scrub areas to take advantage of both the colluvial soils at the foot of the valley slopes and the shade and humus supplied by the scrub. In the wet zone the almost continuous cover of heavy rainforest in the interior is broken by patches of reeds (*Miscanthus japonicus*) and light forest wherever cultivation has occurred and reversion is not complete.

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[7] An investigation into the economic life and social organisation of the Fijian people was carried out in 1958–1959 by Professor O. H. K. Spate of the Australian National University. See O. H. K. Spate: *The Fijian People: Economic Problems and Prospects*, [Fiji] Legislative Council Paper No. 13 of 1959, Suva 1959. The Burns Commission completed its inquiries into the resources of Fiji in September 1959.

[8] Department of Lands, Mines and Surveys: *Annual Report 1956*, [Fiji] Legislative Council Paper No. 11 of 1957, Suva, 1957, p. 24.

The Nineteenth-Century Scene

Prior to and during the period of early European settlement in Fiji the prime factor which influenced the Fijians in their choice of village sites was the need for defence. Villages of the hilly coastal areas were 'perched upon apparently inaccessible spots overlooking their small domains'.[9] Those on the lowlands were normally surrounded by ditches and earth walls surmounted by bamboo palisades lined with plantain trunks.[10] In the interior, fortified sites were built upon hill tops or ridges. Warfare was common, but often took the form of ambushes on individuals rather than sustained fighting.[11] In these conditions the Fijians were 'prevented from cultivating any land beyond the few feet around each man's dwelling; if more was required, the cultivator, afraid to descend into the plain, discovered some spot in the recesses of the mountains where he might plant his yams secure from molestation'.[12]

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[9] C. Wilkes: *Narrative of the United States Exploring Expedition*, Vol. III, Philadelphia, 1844, p. 53.

[10] As at Bua. See E. Im Thurn (Ed.): *The Journal of William Lockerby*, London, 1922, p. 28.

[11] R. A. Derrick: *A History of Fiji*, Suva, 1957, p. 25.

[12] Consul Jones: 'Report on the Trade of Feejee for the Year 1864', in *Brit. Parl. Papers 1865*, [3518], Vol. 54, p. 28. Referring to the Sigatoka Valley, Gordon wrote that 'when these districts were in their normal state the population was all congregated within walled towns, cultivation was either carried on in close proximity to the towns, or else the more distant plantations were visited and worked in arms' (Gordon to Carnarvon, 27 October 1876, in *Brit. Parl. Papers 1877*, [C1826], Vol. 61, p. 226).

Taro and yams were the main food crops. The former provided the greater volume of produce, but the latter were the favourite food and, being a seasonal crop, were the more important socially. The yearly round was largely organised in terms of the activities connected with yam cultivation. In both wet and dry zones taro was grown in artificially-constructed beds, though in the wet zone more was grown on dry ground than was irrigated.[13] In the dry zone, however, irrigation was almost always necessary except in naturally damp situations. On the damp flats raised beds were formed from the earth dug from the separating ditches, but, in the hill country, terraces were constructed and water for irrigation brought to them by ditches or elaborate systems of bamboo pipelines.[14] Williams noted that the slopes 'when thus terraced with mature taro patches, present as beautiful a spectacle as any kind of agriculture can furnish'.[15] Yams were normally grown on plots newly cleared from the forest, and the land allowed to revert after a short period of use. Coconuts and breadfruit were important food sources while minor root crops augmented the food supply. From the forest, edible nuts, roots and berries were obtained.

Agriculture Partially Sedentary

Agriculture, therefore, was partially sedentary, with the cultivation of watered terraces and the use of tree crops continuing for a number of years, and partially shifting cultivation with long periods of bush fallow and short spells of cropping. It would appear that the system of land use was relatively stable and did not impose too great a strain on the resources of the soil. Certainly this was true in the wet zone where regeneration was rapid. In the dry zone however, the Fijian, through the agency of fire, altered the vegetation cover over wide areas. To some extent these fires were started to clear land for defensive reasons, but it is evident that fire also played a big part in agricultural operations. Wilkes saw Fijians on Beqa burning the tall grass before planting, and he considered it 'probable that the practice of burning the yam-beds and clearing the ground by fire may have consumed all the forests [of the dry zone] in dry seasons'.[16] In the wet zone, fires lit to burn trash would spread only with difficulty, but in the dry zone it would be extremely difficult to control such fires. The result was a reduction in the fertility of much dry-zone land and severe erosion on steep slopes.[17]

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[13] B. Seeman: *A Mission to Viti*, London 1862, p. 302.

[14] The actual method of using the terraces was for only a portion of one set of terraces to be cultivated at one time. The plots would be shifted gradually along the terraces so that the soil would periodically lie fallow (J. Horne: *A Year in Fiji*, London, 1881, p. 77). This system is used in New Caledonia at the present time (personal communication, Dr L. Curry).

[15] T. Williams: *Fiji and the Fijians*, Vol. I, London, 1858, p. 61.

[16] Wilkes, *op. cit.*, p. 217.

THE FRAMEWORK OF LAND TENURE

The agricultural activities of the Fijian villager were carried on within a land-tenure framework which was extremely flexible and which exhibited marked regional variety.[18] There were, however, certain features common to most areas. Except in a number of special circumstances land was not owned outright by the individual but rather by the descent group to which he belonged and in which he lived. Land in itself had limited value as exchangeable property prior to the advent of the European. Value and something approaching ownership by the individual or his immediate family lay not with the land but with the results of the labour expended on the land. The crop was the result of labour, was thus of value, and was the property of the planter; the plot of ground was not of value unless it had been developed itself by terracing or reclamation. The greater the value of a piece of land in terms of the crops growing on it, or the amount of labour expended in preparation of the land, the closer the form of tenure would approach outright ownership by the family or individual.

Within the village an individual would have some kinship ties with all other members. The smallest, most-closely related group above the biological family was the *i tokatoka*, an extended family or household. A number of related *i tokatoka* formed a *mataqali*, and several *mataqali* might form an *yavusa*. One village might consist of several *mataqali* without containing a complete *yavusa*, or it might consist of two or more *yavusa*. In the latter case, the presence of two *yavusa* would probably have arisen from the merging of two village communities.

The broad tract of land which the people of the village could effectively occupy or defend was held in common by the whole group. Within this area any member of the group could gather reeds or wild produce. The boundaries of such a tract were often ill defined, and fluctuated with the strength of the group.[19] Within the village tract only patches of land would be suitable for agriculture, but to safeguard these a general claim would be made over the whole area (the *veikau*) in the name of the whole *yavusa*. Once an individual or an *i tokatoka* had improved a piece of land by clearing and planting, rights were established to the continued use of that plot until such time as it was abandoned to revert to scrub or forest. In the sense that it was the social unit of greatest significance as a work group, and thus the unit which established claims to specific plots through planting, 'the *i tokatoka* was in fact the true proprietary unit of Fijian lands'.[20] If within a sector of the village land all the cultivated patches belonged to *i tokatoka* of one *mataqali*, the whole of that sector might be looked on as the preserve of that group. Where there was any pressure on the land, as on the Rewa delta, the boundaries of *mataqali* or *i tokatoka* land were more sharply defined.

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[17] Wright and Twyford, *op. cit.*

[18] Thomson states that no less than eight systems of tenure existed in eastern Viti Levu (B. Thomson, *The Fijians*, London, 1908, p. 357). Most of the systems had certain general features in common, and the present account of these is based largely on Thomson, *loc. cit.*; L. Fison, 'Land Tenure in Fiji', *Journ. Anthrop. Inst.*, Vol. 10, 1881, pp. 332-352; and *Report of the Commission . . . on Decrease of the Native Population*, Suva, 1896.

[19] Consul Jones: 'Consular Report', *Brit. Parl. Papers 1866*, [3582], Vol. 69, p. 604.

Once the land fell idle the individual's rights lapsed after a time and the area reverted to the category of *veikau*. If tree crops had been planted, however, the original planter would always have access to those trees despite the fact that another person might have since taken up the land to plant a root crop between the trees. The whole system was flexible, and if one *i tokatoka* or *mataqali* decreased in number while another increased, the simple fact of abandonment of land by the former released it for use by the latter.

CHANGES IN THE NINETEENTH CENTURY

During the nineteenth century this general system was changing, and no doubt the changes had begun long before 1800. Thomson, following Fison, describes how, through acting as spokesman for the group and thus dealing with the allocating of the waste land, the chief 'came gradually to look upon the waste lands as his private estate'.[21] Likewise, through long use mainly by members of one *mataqali*, more and more blocks of land, including both cultivations and waste, came to be regarded as land belonging to a specific *mataqali* rather than to the village as a whole. This latter process was probably hastened by the realisation that European custom allowed one man to own and occupy an area exclusively even though he actually utilised only a small part of it. Also, the ability to obtain money by selling, leasing or renting land gave unused land a new value. 'European notions [had] been dimly seized upon, and land owners [stood] upon their rights as if they had been bred under the English law of Real Property.'[22] But the most important single change in the land-tenure system came as the result of the survey of native land and the registration of that land in the name of *mataqali* or *i tokatoka.*

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[20] G. K. Roth: *The Fijian Way of Life*, Melbourne, 1953, p. 53.

[21] Thomson, *op. cit.*, p. 362.

After long inquiry these groups were taken to be the basic land-owning units. However, by surveying and registering lands, even though this was done within the framework of custom, one of the basic features of the Fijian system was destroyed. The reallocation of land was no longer simple and was now legally possible only if a *mataqali* became extinct. The land would then pass to the Crown, and in theory could be allotted to other groups by the Crown. The realisation that the survey would be final and binding, and that it was in the interests of the groups to claim as much land as possible, led 'every tribe' to extend its forest boundaries by new plantings as soon as the land court was reported to be about to visit their district.[23] Nevertheless, when an area was finally surveyed, the fact that the land which was recognised as belonging to one *mataqali* could well enclose individual gardens belonging to members of another *mataqali* would not have been regarded as particularly significant by the Fijians. The concept of definite boundaries had been assimilated, but it is doubtful whether the idea of survey and registration giving sole right to the use of land within the boundaries had been fully grasped. The foundation had therefore been laid for some striking anomalies according to European concepts of land ownership.

Changes since Cession

After the Fijians ceded the islands to Britain in 1874 many new influences were brought to bear on the pattern of land use and ownership. With the final establishment of peace throughout the islands in the late 1870's, the shift of villages away from the old defensive sites to more accessible places was accelerated. At the same time there was a marked trend towards planting gardens further from the villages and in a more dispersed pattern.[24] New crops like cassava became more widely used and certain crops such as yams and paper mulberry were planted less frequently. Gradually the taro terraces were abandoned until, today, none are in use on Viti Levu.

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[22] *ibid.*, p. 365.
[23] *ibid.*, p. 361.
[24] Gordon to Carnarvon, 27 October, 1876, *op. cit.*, pp. 225-226.

As a result of the system under which Fijians were required to grow crops for taxes, the growing of cash crops such as sugar cane, maize, copra and tobacco became more widespread. The opportunities for non-agricultural employment increased steadily and, as the attractions of such employment away from the villages increased, the number of independent individuals living in the towns grew and formed new communities in which the newcomer might find a place. The policy and regulations of the administration have always aimed at the maintenance of the traditional village system of social organisation. But new cultural influences have steadily weakened the system as a means of mobilising labour and increasing agricultural production. For the younger Fijian in particular, the communal system offers few incentives and many disincentives.[25] Nevertheless not all areas have progressed the same distance along the path of change.

By examining three sample villages it is possible to appreciate the contrasts which now exist in land-use and tenure patterns, in agricultural techniques, in types of crops, and in the attitude of the people towards agriculture and alternative means of earning money. Saliadrau is representative of the remote interior villages which are inaccessible except on foot. This difficulty of access severely limits the opportunities for cash-cropping. Nakorosule is situated on the Waimimala River and may be reached by outboard-motor boat in one and a half hours from the end of the road. Bananas may be rafted down the river for sale, but no employment other than agriculture is available near the village. The third village, Nailaga, is situated on the main highway within three miles of the sugar mill town of Ba and in the centre of an area of cane production and dense Indian population. Agriculture is only one of a number of occupations open to the people of Nailaga.

THE VILLAGE OF SALIADRAU

Even in Saliadrau, the most remote and inaccessible of the three villages, the system of agriculture now practised is not the 'traditional' one outlined above. About eighty years ago the old fortress high above the river was abandoned and the people moved down to the river bank. Since then sickness and floods have resulted in two further moves, the last in 1952. About 1930 the old taro terraces were finally abandoned and, for this, flood damage was at least partially responsible. However some informants state that the amount of labour involved in the maintenance of the terraces was too great in proportion to the return. In any case only dry taro is grown today. Yams have also declined to the extent that in February 1958 only one fifth of an acre was planted. Cassava was first planted in 1952, to provide a quick source of food after a hurricane had damaged the other crops. It has now become an important crop, and it appears that the increase in the area under cassava has resulted in a corresponding decrease in yam cultivation.

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[25] For a full discussion of this problem see Spate, *op. cit.*

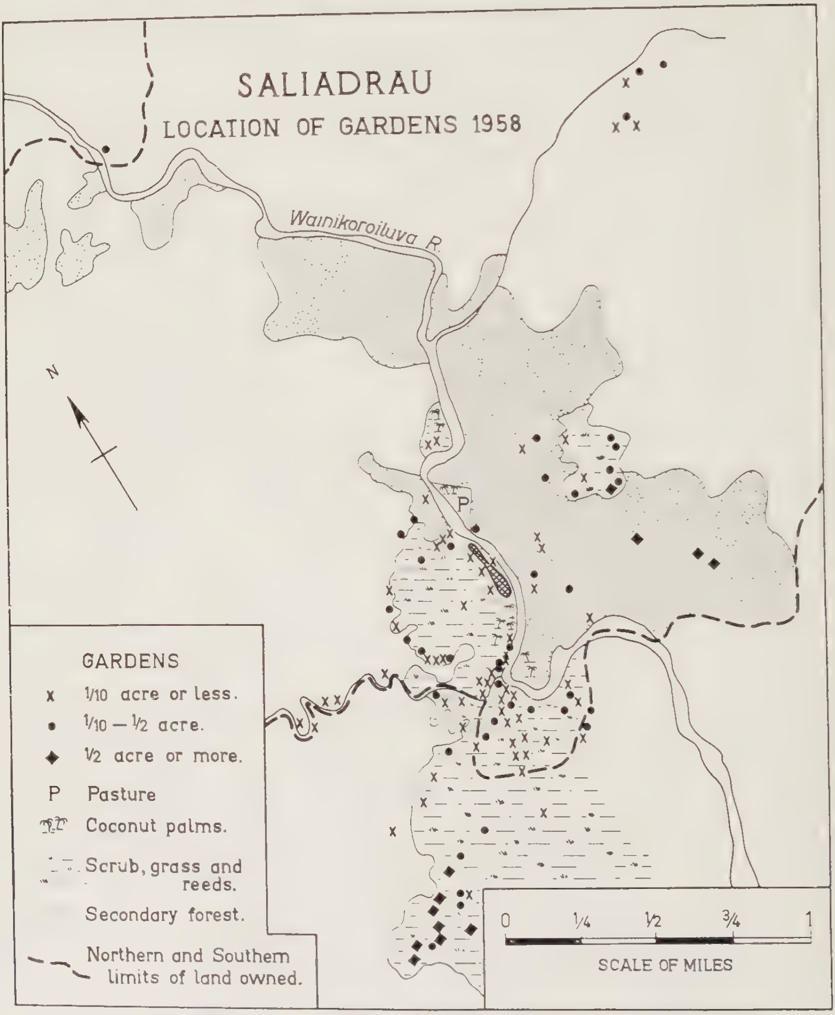

Fig. 2. The village of Saliadrau and its land

Saliadrau is too inaccessible to share in the banana export trade, and bananas are grown almost solely for local consumption. A little fruit has been sold for export in the past but as this necessitates carrying the bananas over three miles of steep tracks before they can be rafted down the river, the business has not been maintained. The only cash crop which it is feasible for the villagers to produce is *yaqona* (kava, *Piper methysticum*). Two or three times a year each household will gather and dry the *yaqona* roots and carry them down to the coast. On each occasion from 100 to 150 pounds of *yaqona* will be sold at a price of from four to five shillings a pound, and, from this income, taxes must be paid and clothing and other necessities bought. The production of all other crops is for subsistence purposes.

TABLE I

ACREAGE UNDER VARIOUS CROPS

*Crop**	*Saliadrau*	*Nakorosule*	*Nailaga*
Taro	11.8	11.1	0.1
Yams	0.2	4.0	0.2
Cassava	3.3	18.6	5.1
Bananas	2.9	163.6	8.5
Yaqona	10.8	3.6	0.2
Coconuts	0.5	32.0	3.9
Sugar Cane	—	—	39.0
Rice	—	—	2.5
Minor Crops	0.3	2.0	0.7
Total	29.8	234.9	60.2
Population, 1956 ..	133	237	465**

*Where an area is intercultivated, with say taro and *yaqona*, the total acreage has been equally divided between the two crops. This does, however, tend to exaggerate the significance of coconuts in Nakorosule where palms are often widely spaced.
**Fijians only.

The gardens of the village are scattered over a wide area (*Fig.* 2) and between them, where the land has already been cultivated and abandoned, are scrub, reeds and light forest. In all there are 115 separate garden plots, giving a total cultivated area of almost thirty acres. A further five acres are in rough pasture. Few plots are larger than one fifth of an acre and only twelve are more than half an acre in extent. There is less than a quarter of an acre of cultivated land per head of population, and less than two acres for each of the sixteen households. As shown in Table I, taro, grown alone or intercultivated with *yaqona*, is the most important crop in terms of area.

The system of cultivation now used is for a patch of forest or scrub near the top of a ridge to be cleared. After the trash has been burned taro is planted. Usually *yaqona* is interplanted with the taro, but occasionally this may not be done until after the first crop of taro has been harvested and a second planted. Even if two crops of taro were taken from the same plot, the land would not remain cultivated for more than eighteen months unless *yaqona* were interplanted. However when this is done the *yaqona* must be left to grow alone after the taro is harvested, and the land thus remains in use for at least five years. On the steep slopes commonly cultivated at Saliadrau this long period permits a considerable amount of erosion to take place. As the taro is harvested the garden is normally extended down the slope and with it comes a great deal of soil. By the time the first *yaqona* is harvested the soil on the upper slopes has often been reduced to the subsoil, or even to bare rock.

Taro and *yaqona* grow best on soil with a high humus content which has just been cleared from the forest. The increase in the area planted in *yaqona* has led to a steady expansion of the perimeter of the agricultural land, and new plots are being established further and further from the village as the planters seek for what they term 'black soil'. The introduction of cassava has led to some renewed use of land, immediately west of the village, which had been cultivated in the past and abandoned. However yields obtained have not been high, for the soil is infertile and the area is too high to receive additional supplies of plant nutrients from flood-deposited silt. Furthermore, the encroachment of *Yaqona-ni-Onolulu* (Honolulu kava, *Piper aduncum*) on to this area has meant a slower building up of humus than formerly took place under reeds and indigenous scrub.

Immediately south of the village is a narrow terrace which is occasionally flooded, has fertile loamy sand soils, and is intensively used for taro plots. Yields are satisfactory provided floods are not too infrequent, but most of the land of this nature and soil type close to the village is already in use.

Nearly half the land owned by the *mataqali* resident in Saliadrau lies more than two miles from the village and the land between is steep and broken. For all practical purposes the more distant land is almost useless while all the people continue to live within the village. Only with dispersed settlement might it be possible to utilise the scattered patches of colluvial soils effectively. The need for more land on which

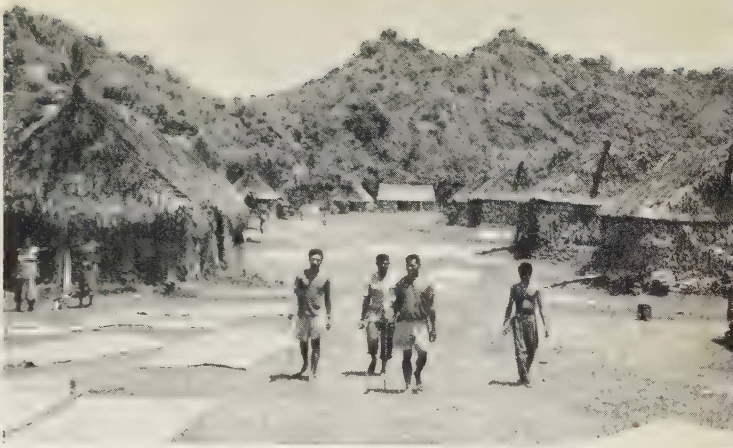

Fig. 3. The *rara*, or 'village green', of Saliadrau. Houses are of traditional style. The steep slopes in the background are used for garden plots

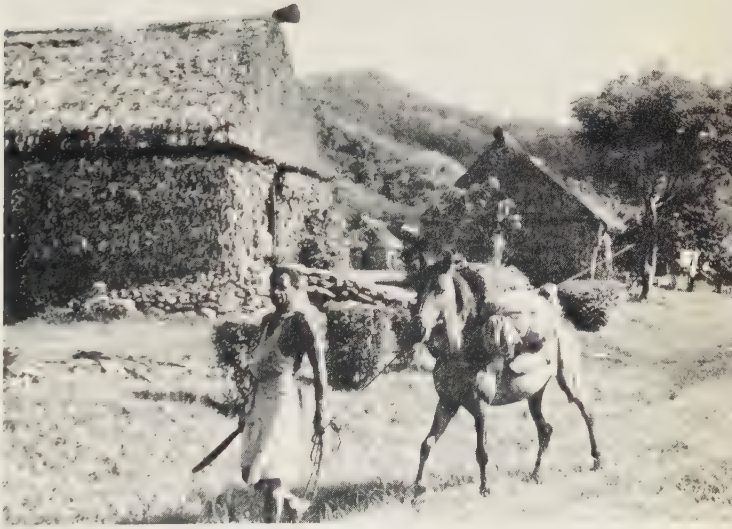

Fig. 4. Bundles of dried *yaqona* roots being taken from Saliadrau to the coast

Fig. 5. In the interior small river terraces are used for banana patches. The steeper slopes are under light forest to grow *yaqona* and food crops is now being solved by planting outside the limits of the land registered in the names of the resident *mataqali* (*Fig.* 6). The area lying to the south of the village is more accessible from Saliadrau than it is from the neighbouring village within whose territory the land legally falls. In this situation the people of Saliadrau have gone ahead and established gardens on this land. Indeed the villagers' largest gardens are found here (*Fig.* 2).

It would appear that this is simply a carryover of the old system of flexible land boundaries or of changing 'spheres of influence' over land. As the neighbouring village concerned is not short of planting land the present situation has developed and continued without question. Even within the area owned by the various *mataqali* of Saliadrau there is not always a direct correlation between the land registered in the name of any one *mataqali* and the land actually used by its members. Of the eighty-six gardens which do fall within the area belonging to the village as a whole, fifty-nine are located on land belonging to a *mataqali* other than that of the planter. Village informants stated that provided no other gardens used by the land owners were situated in the immediate vicinity, a villager of another *mataqali* might go ahead and establish a garden without making any formal request for permission to do so. However, if gardens were already established nearby then a request, perhaps supported by the presentation of a *tabua* (whale's tooth), would be made.

It is likely that the land-tenure and land-use situation found to exist in Saliadrau is repeated in many of the more remote villages of the interior. Provided that the pressure on the available arable area is not great and that the agricultural emphasis is towards subsistence rather than cash cropping, it is unlikely that any serious difficulties will arise as a result of the discrepancies between the ownership of land and the ownership of the crops thereon. It is clear, nevertheless, that the legal land division is a monument to the land-use pattern of a past period rather than a structure closely related to the realities of the present situation.

The Village of Nakorosule

Nakorosule has two major advantages over Saliadrau in terms of prospects for agriculture. The village is accessible by boat, and within the boundaries of its lands are found extensive fertile flats. As at Saliadrau the village has moved down from a hill-top site, the old taro terraces have been abandoned, and yams have declined and cassava has increased in importance. Here, too, there is no form of local employment available apart from agriculture. However, at Nakorosule, accessibility and the presence of alluvial flats have enabled the villagers to participate in the banana export trade. The production of *yaqona* for cash at Saliadrau is an irregular occurrence which may be fitted into the round of local activities whenever it is convenient. Banana harvesting, however, must be timed to suit the timetable of the ships trading to New Zealand, so that agriculture at Nakorosule is a

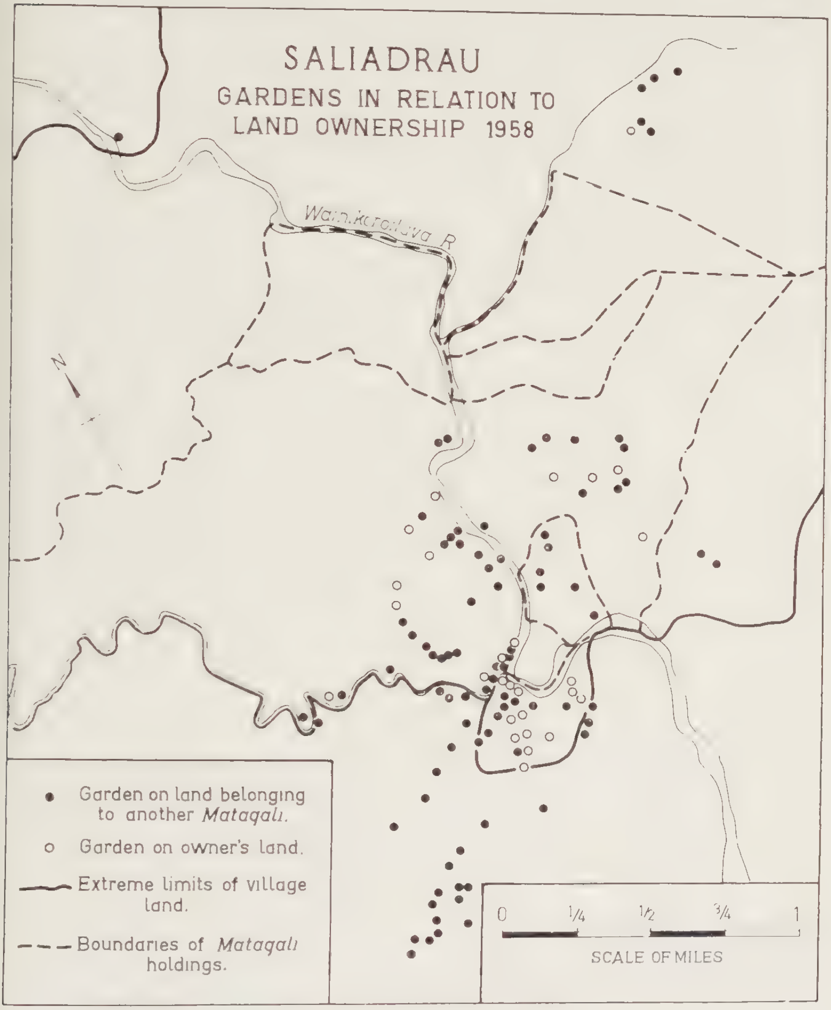
SALIADRAU
GARDENS IN RELATION TO LAND OWNERSHIP 1958
Wainikoroiluva R
N
● Garden on land belonging to another *Mataqali*.
○ Garden on owner's land.
Extreme limits of village land.
Boundaries of *Mataqali* holdings.
0
1/4
1/2
3/4
1
SCALE OF MILES

Fig. 6. Village gardens of Saliadrau

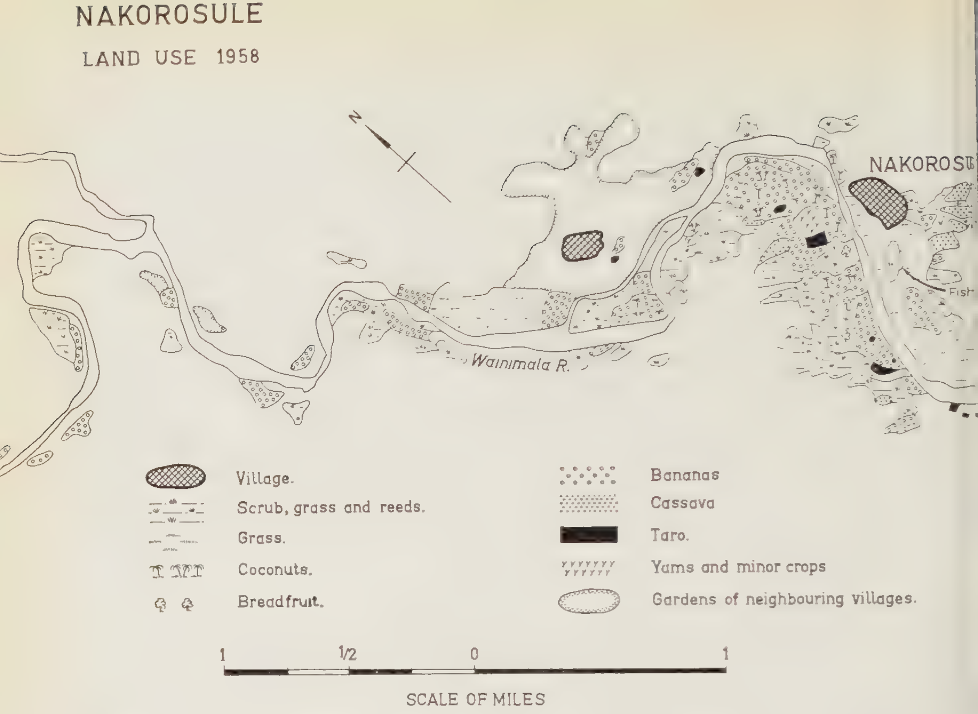

Fig. 7. Land use at Nakorosule in 1958

much more regular activity and one oriented more consistently towards production for cash.

The importance of bananas in the agricultural pattern of Nakorosule is evident from the figures given in Table I. No less than seventy-one percent of the area under crops is accounted for by bananas (*Fig.* 7). Two basic requirements for commercial banana production are easy access to the river (or road) down which the fruit must be sent to the packing stations, and soils on which production can be maintained for a reasonable period of time. As bananas increased in importance at Nakorosule, so the gardens became more and more concentrated on the river terraces. Here occasional floods help to maintain fertility, and, on the sandy silts, bananas will continue to produce fruit for up to fifteen years. At the foot of the adjacent slopes the renewal of plant nutrients is brought about by soil creep from the higher slopes, and on such colluvial soils production may be maintained for a number of years. Over the past fifty years the isolated and remote areas which had previously been cultivated for subsistence crops have been abandoned. People who were living away from the river left their homes and moved to Nakorosule. Even today this process continues and

Fig. 8. Nakorosule on the Wainimala River. Most of the gardens are on the alluvial flat across the river from the village. The hills are gathering grounds

Nakorosule is one of the few interior villages whose population is increasing as people leave the less favoured areas and move to better land and to areas with better access.

Little of the steep land is now cultivated, and where gardens are located on steep-land soils cassava is the major crop (*Fig.* 7). By the use of the alluvial and colluvial soils, shifting cultivation has been replaced largely by permanent cultivation, or at least by the continued use of the same plots for periods of more than ten years.

As yet there is no shortage of land in Nakorosule in terms of the area owned by the village as a whole. This amounts to more than 9,100 acres. The emphasis on banana production, however, has led to the concentration of gardens on the river flats and on the land of a

Fig. 9. Weeding a banana plantation at Nakorosule. Despite this cooperative effort, most work associated with banana production is on an individual or wage basis

few *mataqali*. Of the fourteen *mataqali* represented in Nakorosule, four do not use any of their own land and only one has all its gardens on its own land. Lack of fertile flats or of land near the village and the river, and the decline in the number of members in a *mataqali*, are the principal reasons given for not using their own land. The mechanism of obtaining permission where necessary to use land of another *mataqali* is the same as at Saliadrau. As yet there have been no disputes in Nakorosule over the lack of correlation between ownership and use, but such disputes have arisen from a similar situation in a nearby village. The profit motive and the change towards the concept of the land rather than the crop being the object of greater permanent value are becoming more significant.

The Change to Commercial Cultivation

Two general points arise from a consideration of the situation at Nakorosule and a comparison with that at Saliadrau. First, the change from a form of agriculture which is basically subsistence to one which is basically commercial may result in a great increase in the area cultivated without a corresponding increase in the number of persons supported locally. At Saliadrau 0.22 acres are cultivated per head of population, whereas at Nakorosule the figure is one acre. If bananas are excluded from the Nakorosule total, the figure is 0.3 acres—an area comparable with that for Saliadrau and with that quoted by Barrau as being representative of subsistence agriculture in rainforest hill country of Melanesia.[26]

It is clear that a fourfold increase in the area planted has not resulted in an equal increase in the number of persons supported locally. Much of the additional income has been absorbed in the purchasing of more material goods, and most of these have been unproductive goods. Undoubtedly, however, the increased contribution to the total economy of Fiji is significant and helps to support the increasing number of persons living in the towns and engaging in secondary and servicing industries. It is probable, therefore, that increases in the extent of cash cropping in the interior will not result in any reversal of the drift of population away from the area. The additional persons which the trend to commercialisation of agriculture will help to support will be town dwellers.

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[26] Barrau states that 0.2 to 0.3 acres per head is typical of this economy in this type of environment (J. Barrau: *Subsistence Agriculture in Melanesia*, Noumea, 1955, p. 31).

Second, the shift towards cash cropping—particularly the emphasis on bananas—has, in effect, reduced the area which the Fijian now looks upon as potential agricultural land. The steeper land will produce food crops under shifting cultivation, but not the present exports crops, and it is to these that increasing attention is being paid. The introduction of tree crops such as cacao into the village economy may help in the greater utilisation of all available soil resources. But it will take a considerable time to achieve this, and in the meantime attention will become focused increasingly on the most favoured areas.

The Village of Nailaga

Nailaga is a large village which had a population of 476 in 1956, but of the 20,000-odd acres owned by *i tokatoka* resident in the village, the greater part of the best land has been leased to Indians (*Fig.* 10). The flats and colluvial areas are almost all in sugar cane. Further inland is the steeper terrain, once clad in tall grass, reeds and shrubs, but now reduced by grazing and burning to low hard fern (*Dicranopteris linearis*) and poor grass. Erosion is severe and the ground is often bare with the subsoil exposed. As a result, it has been necessary for much of this poorer land to be designated a conservation, or 'closed', area (*Fig.* 10), within which the existing leases will not be renewed, no new areas will be leased or cultivated, and no grazing or firing will be permitted until the damage already done is repaired.

It is clear from Figure 10 that when the areas leased and 'closed' are deducted Nailaga does not have a great deal of land available for cultivation. Native reserves have now been declared in this district, and as leases within these areas expire a little more land will return to the Fijians (*Fig.* 10). Nevertheless land will still be in short supply in relation to population, and yet despite this situation, the land already held by the villagers is not always well used. The major cash crop at Nailaga is sugar cane (Table I) with cassava and rice as the main food crops. Taro is hardly ever grown, for without irrigation it is difficult to obtain satisfactory yields. Within the village itself are little patches of cassava. These are rarely more than ten yards square and for some families these are the only food gardens. Others have gardens a mile or so away where plots of bananas, cassava and coconuts are scattered amongst scrub and grass (Inset 2, *Fig.* 10). Here, too, are areas under sugar cane. More cane is grown on the land immediately behind the village (Inset 1) and on the farms of exempted men (*galala*) opposite the Rarawai sugar mill (Inset 4).

The block of land behind the village (Inset 1, *Fig.* 10) illustrates several of the characteristics of agriculture in Nailaga. Most of the area has first-class soils but it is not used to capacity. Cane has been grown on most of it at one time or another, but with only a small plot the individual householder is either tempted to try and keep all his plot in cane or rice and dispense with fallows and legume crops (and often with fertiliser as well), or he loses interest and the land lies idle. Sometimes this idle land is used for a single season by Indians on an irregular share-cropping basis, and sometimes it is grazed by Indian-owned bullocks or goats. In return for this privilege the Fijian may persuade the Indian to provide an occasional bag of rice. Essentially the cultivation is haphazard and irregular.

In contrast, the exempted men living further from the village make much better use of their land (Inset 4, *Fig.* 10). One man here has ten acres in cane together with an acre in food crops. Legumes are sometimes planted after the ratoon cane is harvested and fertiliser is applied. Despite the fact that the rotation tends to be rather irregular and tasks such as weeding are not always carried out on time, the general standard of farming and the resulting yields on this and neighbouring farms is much above the village average.

DIVERGENCE FROM THE TRADITIONAL

As a whole, Nailaga has diverged from the traditional patterns of land use, tenure and economy much more than has either of the other villages. Here may be seen some of the effects which the leasing of land and the availability of alternative means of employment have had on village agriculture. In the first place the rents from land provide a considerable income for several of the *i tokatoka*.[27] Largely as a result of this there is a much greater awareness of the value of land in itself as distinct from the crops upon it. This is reflected in the fencing of individual plots, the greater prevalence of the working of land by individuals rather than by groups, and the specialisation in cash crops, often to the exclusion of food crops. Of greater importance, however, is the fact that here there is a much greater correlation between who owns the land and who uses it. Where land has monetary value the old methods of easy reallocation and the free use of another person's land no longer operate.

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[27] In 1957 this amounted to almost £1,000.

At the same time the opportunity of obtaining paid employment has reduced the dependence on agriculture. Some families do not farm at all, and no less than a quarter of the adult males have full-time paid employment as government officials, shop assistants, carpenters, sugar-mill workers, or general labourers. Many others obtain casual work on cane farms, in the cane mill, on the Lautoka wharves, or in the manganese mines. In 1956, for example, more than forty of the adult males worked as cane cutters from May to December. This

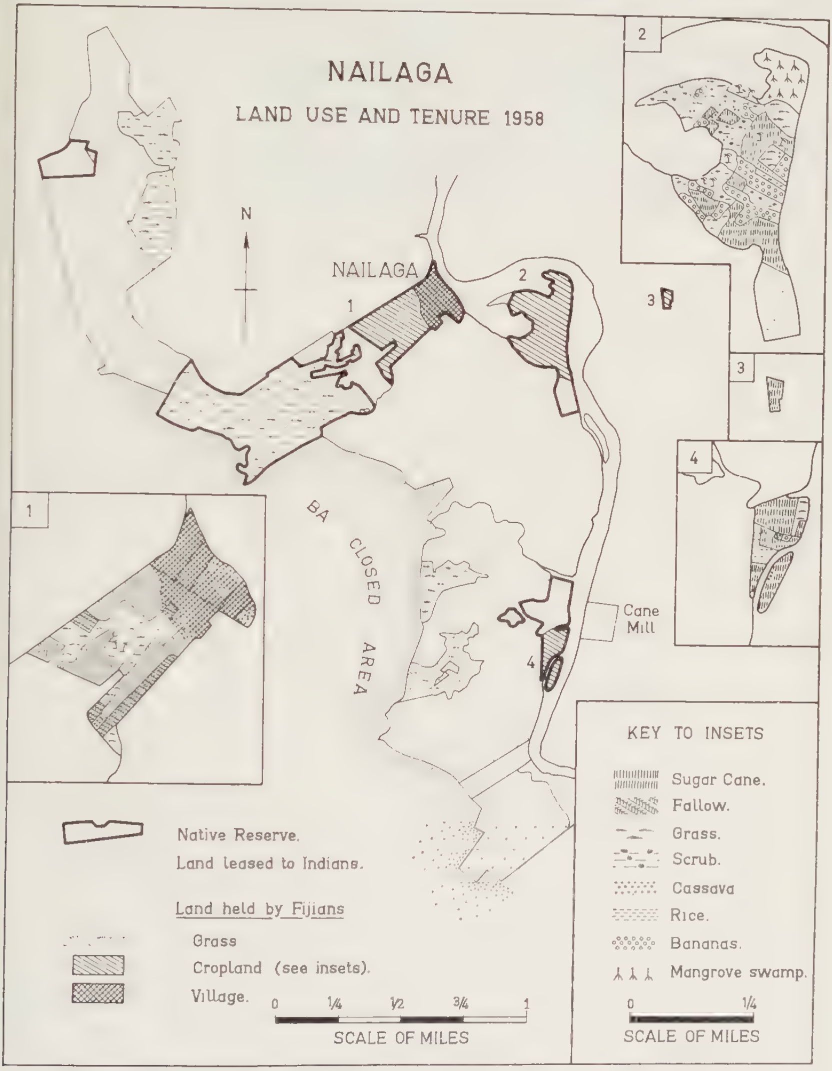

Fig. 10. Land use and tenure at Nailaga, 1958. Much of the land owned by Nailaga people falls within the Ba Closed Area and has been excluded from this map

Fig. 11. Preparing land for dry rice at Nailaga. Bullocks and house-types provide a notable contrast

number included all those under sixty years of age who did not have permanent jobs, and the group earned some £1,200 in this way. Of this sum approximately one quarter went to pay off accounts at the local store and the remainder to a fund for building a new school.

The whole economy of Nailaga is much more commercialised than that of either of the other villages, and with the decline in the importance of agriculture there has been a decline in the importance of communal work. Today most tasks are performed on an individual basis. Communal clearing and ploughing is done by hiring a tractor on contract and the village is kept tidy with a motor mower, not by a communal gang wielding knives. The fact that so many of the adults are engaged in non-agricultural pursuits means that those who depend upon farming for their living are unable to call upon their kinsmen for assistance in major farming operations. So the element of individualism in farmwork is increased. In labour organisation the employer-employee relationship has largely replaced that of kinsman to kinsman as the key to the mobilisation of labour.

Against this background the would-be farmer faces new problems. He is no longer able to obtain free use of the unused land of another *i tokatoka*. Yet, as land is short, he may be unable to establish an economic holding on his own land, particularly if several members of his *i tokatoka* wish to be farmers. To obtain the use of the land of another *i tokatoka* may be difficult without capital, or if any member of that *i tokatoka* should object. As a result there are cases where land owned by people who are not really interested in agriculture lies idle or is misused while those who are interested in farming have insufficient land. It would appear that in Nailaga the old systems of land tenure and social organisation are anachronisms in terms of most

Fig. 12. Erosion inland of Nailaga. An Indian sugar-cane farm is in the left background

economic activities, and changes will be necessary to enable efficient use to be made of the village lands.

THE SIGNIFICANCE OF THE SAMPLE

It would be presumptuous to argue that a sample of only three villages gives a complete picture of village agriculture in Viti Levu. Nevertheless there is ample evidence to suggest that the village types described above are each representative of fairly wide areas.[28] Close to the urban centres are many villages exhibiting characteristics similar to Nailaga; in the more remote parts of the interior are villages of a type of which Saliadrau is representative; and for villages where access is such as to permit participation in cash cropping but where alternative forms of employment are not available, Nakorosule provides an example.

From the examination of these villages certain general conclusions may be suggested. It appears that the system of land tenure and the registration of Fijian land in the name of *mataqali* or *i tokatoka* bears little direct relation to land use in many areas. Informal arrangements have meant that the continually-changing pattern of tenure which apparently existed prior to the registration of land has continued. Such a system is satisfactory when there is little pressure on land and when land in itself has little value. But where, as at Nailaga, the possibility of leasing land has endowed the land itself, as distinct from the crops grown upon it, with monetary value, the traditional system of redistribution is breaking down. In these same areas the present legal land tenure system is not well adapted to the individualistic form of agriculture which is developing. An extension of the system of licenses or leases giving security to the individual is desirable. It might be suggested that the system of tenure now legally recognised is most satisfactory when the land concerned is leased to non-Fijians. Then at least the system insures that the rents are distributed, even though it may be unevenly, amongst those who have some legal claim to the land.

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[28] As well as general observations made by the author in other parts of Viti Levu, certain of the conclusions reached by Spate (*op. cit.*, p. 4), by R. R. Nayacakalou (*Tradition, Choice and Change in the Fijian Economy*, Unpublished M.A. Thesis, University of New Zealand), and by Dr R. F. Watters (personal communication) bear out this assumption.

The characteristics of village agriculture in the interior are such that much of the potentially productive land will not be used unless the pattern of settlement changes radically. Many pockets of good land are too small and too scattered to support whole village communities. It will only be possible to use these pockets with a dispersed settlement pattern. Whether such a settlement pattern could be developed under the present system of social and economic organisation is problematical. Furthermore, the trend away from subsistence and towards commercial agriculture is at present resulting in a concentration of farming on certain types of land. Unless the crop basis of the village economy is widened this trend will continue. In addition, it will be necessary to improve the means of access throughout the interior if those pockets of potential farmland at present lying idle are to be brought into production. To do this may be uneconomic in terms of the returns which will accrue solely from new farm development.

Finally, to increase the area of village cropland may not be an effective means of stemming the drift of population to the towns. It will, however, assist in the general economic growth which will be necessary to support the growing number of town dwellers.

It is clear from the wide variety in the character of agriculture in the three villages described above that there can be no one solution to the many problems connected with the use of Fijian land. Changes in land laws, village administration, or village organisation, which might be satisfactory in a situation such as that at Nailaga, could have disastrous results in a community like Saliadrau. What is required is some system which will be flexible enough to allow communities to move naturally along what appears to be a fairly common path of changing patterns of land use and tenure without imposing artificial barriers to this progress.

RECENT CHANGES IN VEGETATION OF THE CASS AREA OF CANTERBURY*

C. J. BURROWS

IN RECENT YEARS attention has been drawn in the *New Zealand Geographer* to the vegetation cover of the catchments surrounding the Craigieburn Range. These have had several aims, that of Packard[1] being to evaluate the Harper–Avoca watersheds in terms of their use for hydroelectric water supply. Relph,[2] in two papers, discussed the vegetation of the Castle Hill Basin generally and then wrote of changes in this area over the last hundred years.

The Cass area lies at the northern end of the Craigieburn Range in the middle part of the Waimakariri watershed. The Cass Basin is surrounded by mountains from 4,000 to 5,500 feet in altitude, with gaps in the rim at about 2,000 feet to north, east, southeast and south. On the floor of the basin at 1,800 feet are coalescing stream fans and small moraine-dammed lakes (*Fig.* 1). The Cass watershed proper lies in a large bend in the Waimakariri River into which flows the Cass River, draining the basin. Wide expanses of shingle riverbed fill the large glacier-shaped valley, and tributaries of the Waimakariri River, the Hawdon and Andrews Rivers, with long leading ridges between them, enter opposite Cass.

There is evidence of profound modification of the plant communities in the Cass area, consisting mainly of a considerable reduction in beech forest and snow-tussock grassland above the forest, and of an increase in short tussock, bare shingle and scrub. These changes with the evidence for them are discussed below. They occurred largely before the advent of Europeans and, although no absolute date may yet be set for their beginning, they probably began at least 300 years ago and continue to the present day. Alterations in plant cover were initiated by one or a series of catastrophes. These were most likely to have been

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*The implications of these changes for plant variation are discussed in C. J. Burrows: *Variation in Some Species of the Genus* Pimelea, Unpublished M.Sc. Thesis, University of Canterbury, 1958.

[1] W. P. Packard: 'Lake Coleridge Catchment', *N.Z. Geographer*, Vol. 3, No. 1, April 1947, pp. 19–40.

[2] D. H. Relph: 'The Vegetation Cover of the Castle Hill Basin', *ibid.*, Vol. 13, No. 1, April 1957, pp. 41–55, and 'A Century of Human Influence on High Country Vegetation', *ibid.*, Vol. 14, No. 2, October 1958, pp. 131–146.

fires. Figures 1 and 2 show present and former vegetation cover, the latter being deduced from available evidence.

DISTRIBUTION OF REMNANTS OF FOREST AND SNOW TUSSOCK[3]

Near Cass continuous forest occurs to the north of the Waimakariri River. To the south of this river in the Cass area extensive tracts of forest are found only in the upper Cass Valley and in the valleys on either side of Betwixt. Elsewhere forest occurs only as scattered stands, or as small groups of trees on the slopes of mountains surrounding the basin. On even the most dry, bare and exposed hillsides there are to be found groups of *Nothofagus* trees, and the upper limit of these is the same all round the Cass basin—about 3,500 to 4,000 feet. This is approximately the altitude of the treeline in other areas of Canterbury where forest is continuous. The presence of even a few beech trees on a high, exposed, rocky bluff, or on a bare hillside, amongst short tussock and remote from others of the same species, is taken to indicate the former presence of more extensive forest. In some cases such trees are known to date from fires lit by Europeans. Both Poole[4] and Holloway[5] stress that *Nothofagus* species are slow migrators, and that they advance as a wall of forest. It would be difficult for a group of trees to arise independently high on a hillside. Another factor mentioned by Poole is that beech seedlings advance into tussock country only under influence of large trees. These points tend to support the contention that isolated trees have not sprung from widely-disseminated seeds but are relics of a previously continuous forest which have escaped the early fires. This, together with the present occurrence of the forest fern *Polystichum vestitum* and forest shrubs in some tussock areas remote from forest, and stumps of bush burned about 1916 on the Cass Valley slopes of Mt Misery and Mt Bailey, has enabled much of the map of former forest distribution to be constructed.

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[3] In this and further discussion the term 'snow tussock' refers to a community dominated by members of the large tussock grass (*Danthonia flavescens*) complex, with many other herbs, woody shrublets and shrubs of less physiognomic importance. 'Short tussock' refers to grassland with *Festuca novaezealandiae* dominant and members of the *Poa colensoi* complex as local codominants or subdominants. *Poa caespitosa* may also be a local dominant, codominant or subdominant, especially in moist, shady sites. Many herbs, shrublets and some shrubs are also found in the community. 'Scrub' is a collective term for several different types of shrub community including pure *Discaria toumatou*, pure *Leptospermum scoparium*, pure *Cassinia fulvida*, often open, with grassland species between shrubs. 'Mixed scrub' is varied, is dense and usually contains *Discaria*, *Cassinia*, *Coprosma spp.*, *Hebe spp.*, *Olearia spp.*, *Corokia cotoneaster*, *Aristotelia fruticosa*, *Dracophyllum longifolium*, and others. There is also a ground flora of small shrubs, herbs, ferns, occasional tussocks and other grasses. 'Forest' refers to pure mountain beech (*Nothofagus cliffortioides*) forest with very little ground flora except mosses, lichens, liverworts and beech seedlings. Some fern and shrub species are found in places. North of the Waimakariri, red beech (*Nothofagus fusca*) is found in midslope stands, and shrubs are more varied.

[4] L. Poole: 'The Ecological Significance of the Central North Island Ash Showers: The Vegetation', *N.Z. Ecol. Soc.: Rept. Second Annual Meeting*, 1953, p. 13.

[5] J. T. Holloway: 'Forests and Climates in the South Island of New Zealand', *Trans. Roy. Soc. N.Z.*, Vol. 82, 1954, p. 329.

Destruction by Fire

The destruction of a large part of the Cass forest took place in historical times. Exact knowledge of dates and areas burned since the first European settlement of the area in 1857 is scarce, but some written, photographic and word-of-mouth records, supported by some tree-ring counts, are available. From 1857 to 1916 burning was frequent. Cockayne and Foweraker[6] said in 1916 that burning had already had an important effect on the species composition of the vegetation, particularly grassland. No very early records make mention of dead stumps or of widespread windfall dimpling in the region, but burnt *Nothofagus cliffortioides* logs are known to rot completely within seventy years. Photographic evidence puts the date of one early forest fire, extending from Betwixt to opposite the present Grasmere homestead, at pre-1872.[7] No charred stumps of this fire are to be found now, although pieces of rotting log are found, partially buried by soil, in a few places. The lack of stumps possibly results from their burning by later fires. The fire probably burned the area on which the Grasmere homestead now stands and destroyed bush on Mt Baldy.

Further photographs taken about 1916 show that a fire had destroyed the bush from the edge of the previously mentioned burn, to beyond the forks of the main Cass River on both sides of the valley. The stumps of this burn are still standing and there are scattered clumps of trees remaining, some at an altitude of about 4,000 feet. A patch of young regeneration, of even age (about thirty-five years) extends for 300 yards beyond Cirque Creek on the north side of the north branch of the Cass River. Occasional burned trees stand amongst this, and there are patches of older trees scattered amongst the regeneration. Two other widespread fires between 1916 and 1956 are well known and there may have been other grass and scrub fires. The fire of 1956 destroyed an area of bush in the valley of Ribbonwood Creek. In 1947 a grass and scrub fire on Cass Hill, on the fans below it, and on Sugarloaf burned an area of dense mixed scrub which gave way to scattered *Cassinia* and *Discaria* scrub and short tussock.

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[6] L. Cockayne and C. Foweraker: 'The Principal Plant Associations at Cass', *Trans. & Proc. N.Z. Inst.*, Vol. 48, 1916, p. 166.

[7] Personal communication, Mr D. McLeod.

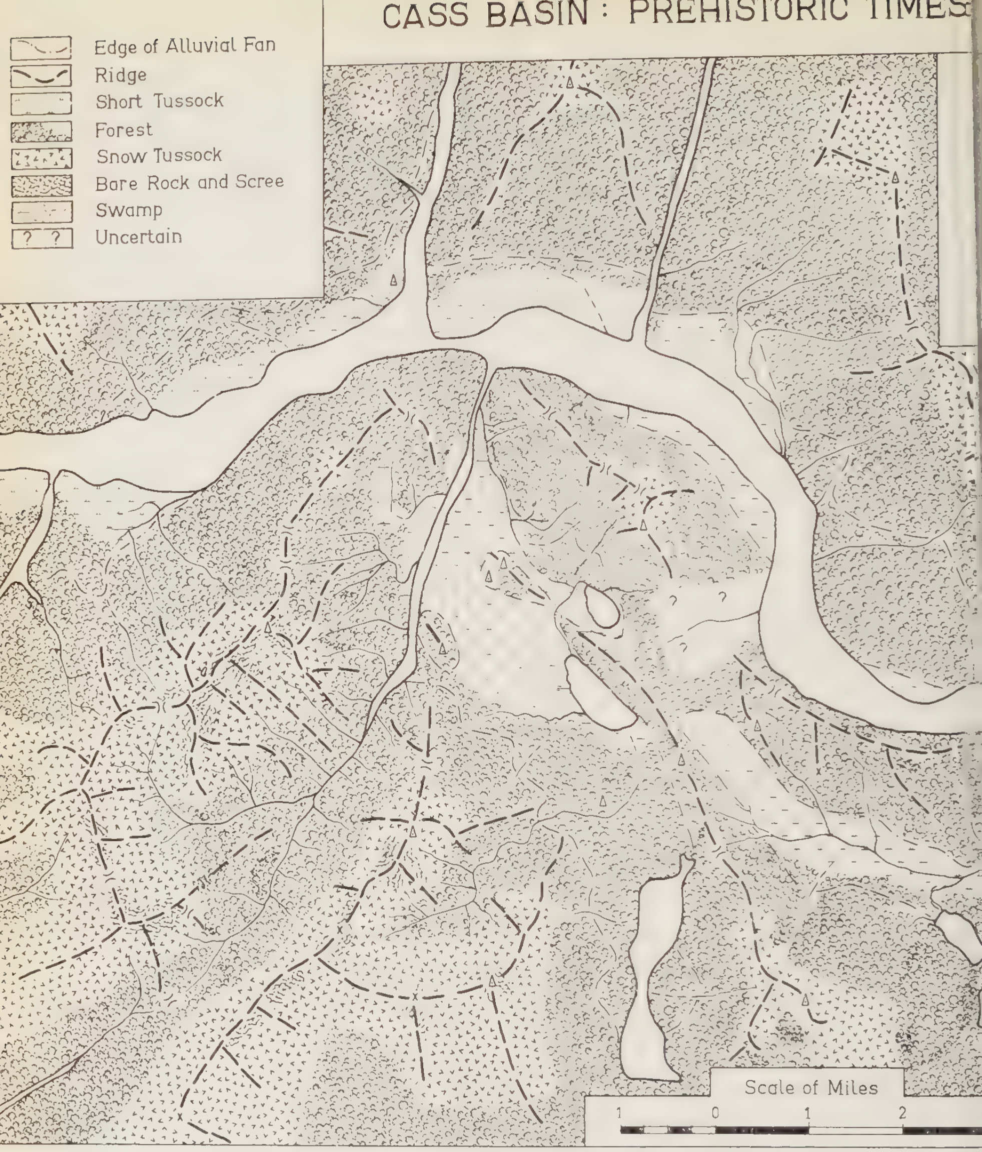

Fig. 1. A reconstruction of the vegetation of the Cass Basin in prehistoric times

Outside the Cass catchment other fires are known. In 1895 an extensive burn above the Bealey hotel[8] and on Mt Bruce probably extended to the north face of Mt Misery. The Hawdon–Riversdale bush edge was burnt back about 1870 prior to oat growing there. Still other fires are known for the Mt White and Craigieburn areas. Photographs of the area in the mid-1870's which have been preserved in the Canterbury Museum show similar conditions to those prevailing

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[8] R. Dick: 'Sixty Years after a Mountain Beech Forest Fire', *N.Z. Journ. Forestry*, Vol. 7, 1956, p. 104.

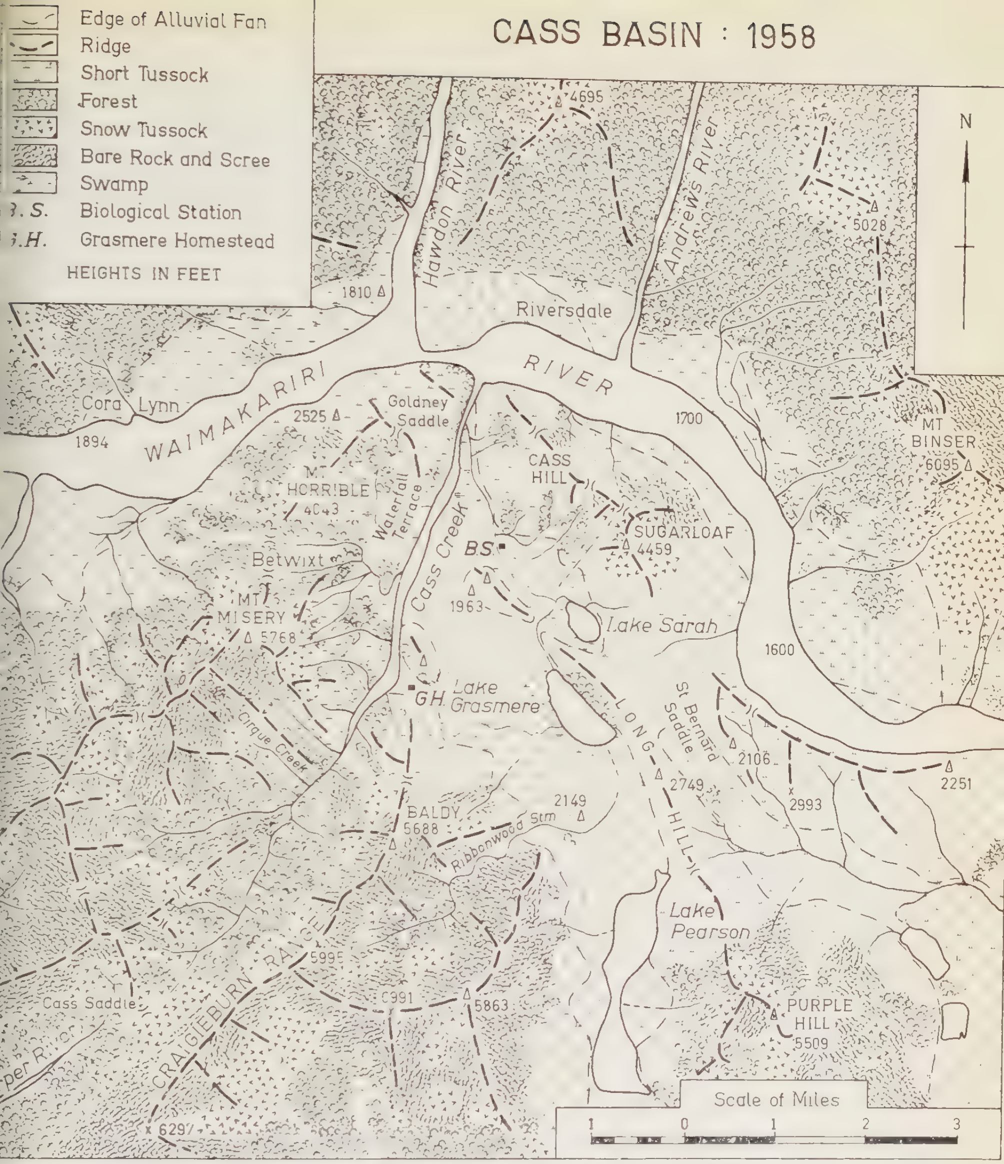

Fig. 2. The vegetation of the Cass Basin at the present time

now, and it is probable that these conditions had been extant for a long period. Much of the forest destruction must therefore have occurred before the advent of Europeans. In the adjacent Harper-Avoca watershed there are large areas of *Nothofagus cliffortioides* bush, of even age, but varying in age from place to place and apparently dating from periodic catastrophes.[9] Some of these are due to fire in pre-European times and others to snow avalanche and windthrow.

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[9] Personal communication, Mr J. Wendelken, 1958.

The examination of tree ages at Cass was not exhaustive. In a large extent of forest near the Cass forks, trees are of varying ages—from 40 to 150 years. These exist in mixed stands, but an age class of 100 to 120 years is common. The oldest of these trees are often broken-crowned and numbers are windthrown. It appears that they are approaching overmaturity. Trees older than 150 years may be present.

Different in structure are the areas mentioned previously as dating from the 1916 fire and the patches of young regeneration on numbers of large avalanche chutes in the upper Cass catchment dating from the heavy snowfall of 1945. These have young trees, six to ten years old. Both types of young regeneration areas carry very dense stands of small trees. In the upper reaches of the main Cass valleys a complex set of conditions exists, with patches of old trees and younger, even-aged stands of different ages alternating in a mosaic pattern. Avalanche and windthrow have contributed to this.

In smaller patches of bush on Betwixt, Cass Hill and the Sugarloaf Valley a pattern of distribution is found. There is a large nucleus of old, tall, straight trees a hundred to two hundred years old, or more, then an incomplete circle of old, gnarled and branching trees which have grown up at the bush edge, and finally, around most of the edges of forest, pole stands of fast-grown trees, a step lower than the canopy. These latter vary in age from 40 to 80 years. The oldest trees are approaching overmaturity.

A small gnarled beech tree at 4,000 feet of altitude on Sugarloaf was more than 140 years old, and a gnarled 'old man' *Discaria* bush below Betwixt was of the same age.

No Single Catastrophe

These findings are not fully consistent with there having been a single catastrophic destruction of forest. By relating the evidence in this area to that found in the Castle Hill Basin, a clearer picture emerges, however. In that area, four miles south of Cass, copious buried charcoal found in soil profiles[10] shows that an ancient forest was destroyed by fire some centuries ago. When the age of the forest is found by radiocarbon dating this may be found to apply to much of the middle Waimakariri catchment, including the Cass area. The charcoal lies above a fossil soil profile which reveals a bright orange or yellow-brown B horizon. At Cass traces of buried charcoal, most of it dating from recent fires, were found. One exposure was similar to the Castle Hill Basin exposures and lay above the yellow-brown old forest subsoil, although remote from present forest. Other traces of buried forest soil profiles were also found. It seems that the fire history of the area is complex and that destruction of a large part of the original Cass forest, leaving only clumps of trees scattered around the basin, occurred in several stages.

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[10] Personal communication, Dr P. Wardle and Mr B. P. Molloy, 1958, together with field observation.

The present distribution of snow tussock in the Cass area parallels that of beech forest in certain respects. Very little snow tussock in pure, dense stands exists. More or less continuous snow tussock is present on the tops above the Hawdon and Andrews Rivers to the north of the Waimakariri, but to the south only in the upper valley of the south branch of the Cass River is there any considerable amount. On Sugarloaf, at 4,000 feet, there is an almost continuous area, covering some acres, but elsewhere only very small patches still remain. These are above the upper limits of forest and are in the form of small islands between shingle slides, or of larger patches on gentler slopes, and seldom provide complete cover. The evidence in favour of the former greater extent of snow-tussock grassland is mainly derived from the present distribution of soil types and is discussed in the next section. However, plants usually associated with snow tussock, such as *Drapetes dieffenbachii*, *Suttonia nummularia* and *Dracophyllum pronum* occur as apparently depleted subalpine communities around the basin. They indicate the former presence of snow tussock. The removal of this has been effected by fire and by encroachment of shingle from above.

THE DISTRIBUTION OF FOREST AND SNOW-TUSSOCK SOILS

The other major evidence used in determining the areas of former forest was soil distribution. A provisional map of soil types[11] shows soils with orange-coloured lower horizons on midslopes of mountains surrounding the Cass Basin to have been formed under forest. In a few cases these indicate that the timberline has been lowered a few hundred feet, usually by fire. There are Bealey soils on Mts Misery and Horrible and on the faces of Mt Baldy and Hill Q. On Cass Hill and Purple Hill there are Tekoa soils. The upper and lower limits of these in the areas mentioned are similar to the extent of beech forest shown in Figure 2. In the areas not within the Cass catchment other forest soils, namely Katrine and Lewis soils (as well as Bealey) are found. To the north of the Waimakariri and on the west of Mt Misery these also occupy the same area as is shown in forest in Figure 2. It must remain uncertain whether forest grew on the area between Lake Sarah and the Waimakariri. This area is occupied by the Cass soil, and is indicated as 'uncertain' on the map (*Fig.* 2). Some of the soils mapped by the Soil Survey bore forest recently, others in ancient times, and in some cases enough time has elapsed for the development of a new forest or grassland soil profile which is now superimposed on the old one.

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[11] Published by the Soil Bureau of the D.S.I.R. in 1952.

In Figure 2 areas shown as bearing short tussock in former times coincide almost exactly with the Tasman soil type which is a recent or young soil developed under short tussock on greywacke alluvium in mountain regions.

SOIL TYPES ABOVE THE BUSHLINE

Above the bushline three soil types are found. North of the Waimakariri is the Spenser soil, and south of it, the Kaikoura and Alpine soils. The first two are found under snow tussock and alpine herbfield, while the last usually consists of bare rock and scree. Details of these distributions in the Cass area are fragmentary, but most probably many former areas of Kaikoura soils have deteriorated to give the bare rock and screes of Alpine soils. Indeed most of the area shown on the Soil Survey map as bearing this Alpine soil was probably once Kaikoura soil with a cover of snow tussock. Deterioration in climate has probably enabled this change to occur.

More detailed information is available for the adjacent Craigieburn Range in the Tussock Grassland Research Committee Report[12] where severely-eroded snow-tussock country is described in these terms:

> At no time would the cover of vegetation have been complete. Screes were always a feature of steep slopes at these altitudes but these screes have undergone rapid and recent extension and, as shown by the extent of bare Kaikoura subsoil, must deteriorate further. Remnant subsoils may still be found in pockets close up under the summit of the range at 5,000-6,000 feet.

These relic subsoils are intermixed with rocky debris, and chemical analysis is consistent with their having once been subsoils of strongly-leached Kaikoura soils. The same conditions apply to the Cass mountains.

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[12] Tussock Grassland Research Committee: 'The High Altitude Snow-Tussock Grassland in the South Island, New Zealand', *N.Z. Journ. Sci. & Techn.*, Sect. A, Vol. 36, 1954, p. 335.

THE OCCURRENCE OF FLORISTICALLY-MIXED COMMUNITIES

Interference with the natural plant cover on the scale suggested by the above evidence would result in the development of replacement vegetation which might well be of a floristically mixed type. Several species which are normal in snow-tussock grassland at Cass are also found among short tussock and mixed scrub at low levels as well as at higher altitudes. These include species regarded by Barker[13] as differential for the *Danthonia-Celmisia* alliance on the Hunter Hills. Conversely, other species considered by Barker to be differential for the short-tussock grassland also occur on the slopes of Cass Hill. Of twenty-one species differential for the *Danthonia-Celmisia* alliance at Hunter Hills, the following are found either mixed with short tussock on low fans or mixed with scrub and short tussock on Cass Hill, as well as in true snow-tussock vegetation near the summit of Sugarloaf: *Danthonia flavescens, Celmisia spectabilis, Brachycome sinclairii, Rhacomitrium lanuginosum, Anisotome aromatica, Gaultheria depressa, Drapetes dieffenbachii, Euphrasia zealandica, Danthonia setifolia, Thelymitra longifolia.* Other species which are, in the writer's experience, normal in snow-tussock grassland or scrub above the bushline, and which at Cass are found among short tussock and scrub at low levels as well as high on Sugarloaf are: *Podocarpus nivalis, Geum parviflorum, Pratia macrodon, Aciphylla colensoi, Dracophyllum longifolium, D. uniflorum, D. pronum, Gaultheria rupestris, Lycopodium fastigiatum, Suttonia nummularia, Cyathodes colensoi, Celmisia lyallii, Exocarpus bidwillii* (on rock), *Pimelea traversii, P. lyallii.*

Of twenty-three species differential for the *Festuca-Poa* alliance at Hunter Hills the following plants are found at Cass on the low fans as well as on the high slopes of Cass Hill: *Poa caespitosa, Linum catharticum, Agropyron scabrum, Dichelacne crinita, Geranium microphyllum, Discaria toumatou, Lagenophora pumila, Acaena sanguisorbae. Festuca novaezealandiae* is also found well above its normal altitudinal limit.

Further than this, it may be possible to regard the number of known and apparent plants of hybrid origin in the Cass area as being evidence of violent disturbance of the vegetation. Hybridisation can be wide-spread only when habitats are disturbed, and variation in the genera *Dracophyllum, Acaena, Pimelea, Gaultheria, Nothofagus, Coprosma, Hebe, Celmisia* and *Podocarpus* at Cass appears to be due, in the main, to this cause.

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[13] A. P. Barker: 'An Ecological Study of Tussock Grassland, Hunter Hills, South Canterbury, New Zealand', *D.S.I.R. Bull. No. 107*, 1953.

The indication from these distributions is that disruption of the vegetation has allowed migration downward of members of snow-tussock community species which otherwise are confined in fairly rigid altitudinal belts, often separated from short tussock by forest. The range of altitude involved is 2,000 feet, and the species mixed with short tussock are found at an altitude of 1,800 feet—well below the norm for them. It might be suggested that the mixing of the two vegetation types to give such a floristically-varied community as is found on the upper fans at Cass is attributable to the fact that the area is one of transition in climate. If this were so it would be difficult to account for the presence of both typical snow-tussock vegetation and typical short-tussock vegetation in well-defined altitudinal belts on the drier mountains to the east. Other vegetation elements in the forest (*Olearia arborescens, Danthonia cunninghamii, Archeria traversii*) do, however, have their eastern limit at Cass, but this does not seem to bear on the problem.

Evidence of Climatic Change

Direct and indirect evidence for the decrease of forests may be adduced this way. It may be that this decrease is not all the result of destruction just before and following European occupation. Evidence exists for climatic change,[14] and in some districts in the South Island retreat of forest has been caused by increasing dessication. That the climate was once more equable in the Cass area is suggested by the disjunct distribution of some subalpine and alpine species. The grassland and associated vegetation in and near the high basins in the upper Cass River is very similar to that now found at Arthurs Pass, at similar or greater altitude, where rainfall amounts to 157 inches. The rainfall in the upper Cass is not known but must be considerably less than this. (The mean annual rainfall at Bealey, six miles to the west is a little more than sixty inches.) Only remnants of vegetation of these types, which include species such as *Danthonia crassiuscula, Celmisia bellidioides, Parahebe linifolia, Geum uniflorum, Ourisia sessilifolia, Senecio scorzoneroides* and *Gentiana divisa*, are to be found there. Similar evidence on the tops above and east of the Hawdon River points towards deterioration in climate. There, a few patches of *Haastia sinclairii, Celmisia haastii* and *Hectorella caespitosa* are found with species of *Danthonia* (*D. flavescens, D. oreophila* and *D. crassiuscula*) in only the most sheltered positions among large boulder fields. Extreme examples of disjunct distribution are afforded by *Senecio cassinioides* and *Celmisia coriacea*, each confined, so far as is known, to one or a few plants in the Cass district. Both are common in the subalpine zone of wetter regions and appear to be relics here.

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[14] See particularly Holloway: *op. cit.*

The distribution of large red beech trees (*Nothofagus fusca*) on the midslopes between Cora Lynn and Mt Binser and up the Hawdon River also points to climatic change. Holloway has shown how midslope red beech is a carry-over from a previous warmer climate. Former extensive red beech forest has become restricted to the present narrow zone by mountain beech descending from its former site above the red beech, by way of streams, to occupy less favourable areas both below and above the red beech. Even where red beech is scantily distributed or absent now, swarms of hybrids between it and mountain beech are to be found. Hybrid trees are found in Sugarloaf Bush and Reservoir Bush above the Biological Station, others are present in the Cass Valley near Grasmere Station, and many are found between the Hawdon River and Mt Binser. Further, in the Cass and Castle Hill areas fossil podsol soils now under grassland indicate that rainfall was once much heavier—from 70 to 100 inches at least.

FOREST CLIMATE AT CASS

In spite of this deterioration in climate it is considered that, except for the drier sunny faces and sites that are too well drained, too cold, or lie at too high an altitude, much of the Cass Basin still has a forest climate. Holloway[15] has shown that *Nothofagus cliffortioides* can grow successfully and regenerate where rainfall is as low as twenty-five inches, and at Cass the annual rainfall is fifty inches. This is supported by the fact that large areas of forest with plentiful regeneration grow further to the east in the low rainfall of the Castle Hill Basin. The requisite conditions for regeneration of beech forest seem, in this area, to be a large body of forest maintaining a moist and sufficiently warm microclimate and preventing desiccation by nor'westers. These conditions are most usually found on slopes facing south to east. Cockayne and Foweraker[16] thought that the present distribution of vegetation was similar to that in pre-European times, that in general the Cass

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[15] J. T. Holloway: 'Ecological Investigation of the *Nothofagus* Forests of New Zealand', *N.Z. Journ. Forestry*, Vol. 15, 1948, p. 401.

[16] Cockayne and Foweraker: *op. cit.*

Basin did not possess a forest climate except in shady, sheltered gullies, and that short tussock was the main climax vegetation which eventually would replace scrub communities. Further, these writers stated that forest was missing, not because of its destruction by fire, but because climate was unsuitable for it. In the light of recent research many of these statements are shown to be erroneous, although on exposed slopes short tussock may well be the climax vegetation. Widespread regeneration of forest throughout the Cass Basin may never be brought about because of the difficulty of establishment in the harsh tussock environment, because of the grazing of seedlings and young trees by stock, both domestic and feral, and because of recurrent fires which kill both young trees and suitable nursery scrub.

Regeneration of Beech Forest

Nevertheless, in the larger areas of forest, regeneration of beech is found. In the depth of the forest, saplings and pole trees are noticeably absent but are present in cleared open areas, and round the edges of some of the beech forest there is an advancing line of young trees. These are often browsed back by stock. This regeneration is especially evident between the Hawdon and Andrews Rivers, and it is evident that the present forest edge there is an artificial one induced by fire. Most of the scrub areas are believed to have held forest at one time. *Dracophyllum*, *Leptospermum* and *Cassinia* increased where bush was burned.

A comparison of grassland communities now growing on areas known to have been burnt over at different times indicates that short-tussock grassland is not necessarily the natural cover in the absence of fire. Some areas of grassland owe their existence to recurrent fires which prevent the development of scrub, and some scrubland is clearly replacing grassland. The presence of a few sapling beech trees in some scrub areas near older beech trees indicates that there is still a forest climate, particularly on the more shady aspect, and this rather dense scrub acts as a nursery for young *Nothofagus* trees. The very dense *Leptospermum* scrub which increased rapidly on the Mt Misery–Waterfall Terrace–Goldney Saddle areas in the period 1916–1955 is now severely affected by manuka blight. Regeneration of snow tussock is in little evidence in the Cass catchment, although associate species appear to be reseeding. Further east along the Craigieburn Range many snow-tussock seedlings are found. Accordingly it must be a combination of local conditions which prevents their development at Cass.

Pollen Analysis of Peat

A preliminary examination of peat from a bog near St Bernard Saddle[17] has been interpreted as showing changes in plant species composition in the surrounding district due probably to climate oscillations within the last thousand years. The lower stratum shows *Nothofagus* dominant but then, in a second stage, *Podocarpus* (with some *Podocarpus dacrydioides*, members of the *P. spicatus–ferrugineus* group, various shrub species and some *Metrosideros sp.*) is dominant and *Nothofagus* much less prominent. Finally, in the uppermost layer, *Nothofagus* again assumes greatest importance and *Podocarpus* becomes insignificant. In support of the thesis that the expansion of grassland at Cass is recent, there is very little grass pollen found in the upper peat stratum (2.5 percent of the total spores) while beech pollen comprises sixty-six percent of the total. If grassland had been as widespread as at present when this peat was laid down, grass and associated pollens would be expected to comprise much more than half of the total spores. This evidence favours strongly the proposal that climate deterioration has occurred recently.

Discussion

The facts presented above point toward the need for evaluating present plant cover, especially in South Island high country, in terms of dynamic processes which are still occurring.

Superimposed on the complex geological structure with its easily-shattered greywacke rock, made more friable by the frequent fault crush zones, is the climate, harsh and extreme, especially on the highest, barest and steepest slopes. Here the light winter snow cover allows frost further to shatter the rock. Rainfall is high by the standards of the Canterbury Plains, but is made much less effective by the high evaporative power of frequent nor'westers combined with high summer temperatures.

Climate recordings taken at Cass at 1,800 feet showed the stringency of climate. The lowest temperature in winter, recorded on the tussock fans in 1957, was 8°F, and the highest summer temperature was over 85°F. Frosts occurred every month and daily summer temperatures were consistently above 80°F. Plants from Cass grown at Christchurch always flourish more luxuriantly so that, in particular, the moisture available for plant growth is less in the mountain station. The growing season for plants here is also short, lasting about 4-5 months. Climate is undoubtedly more severe now than it was at some former time when forest covered the mountain slopes and snow tussock the tops. Holloway states that climate deterioration, beginning about 1200 A.D., caused beech forests in certain sites in high-country Canterbury to be

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[17] Unpublished information supplied by Mr N. T. Moar and Mrs P. E. Young, 1958, and Mr H. Lintott, 1959.

> . . . . rendered unstable through increasing desiccation and [they] were replaced, commonly through the agency of fire, by manuka scrubland or tussock grassland . . . Without question, also, the fires destroyed forests which were in themselves fully stable and some of these did not recover since recovery depended entirely on survival of seed sources . . . . Many existing forests are wholly young forests, this applying particularly to the mountain beech forests of the drier Canterbury ranges.[18]

Large fires are known from Maori legend. They may have been lit naturally or by the Maori himself. It is evident that vegetation changes had begun long before the European settled the middle Waimakariri Basin but his coming, with the effects of frequent burning, and grazing by sheep, deer, chamois and hares, combined with the complex of shattered rock, deteriorating climate and unstable vegetation, added impetus to a chain of events culminating in a new erosion cycle which threatens to choke the Waimakariri riverbed with shingle. It is unfortunate that the ancient forest soils are so susceptible to erosion by frost, wind and water.

The future of the middle Waimakariri Basin depends on an appreciation of all these many factors of the environment.

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[18] Holloway: 'Forests and Climates in the South Island . . . . .', *op. cit.*

ATMOSPHERIC CIRCULATION IN THE SOUTHERN SOUTH PACIFIC

LESLIE CURRY

NOWHERE is there available a relatively compact study of weather in the higher latitudes of the South Pacific. There are reasons for this lack. Apart from the western parts, it is probably the least-visited area of any in the world, so that more is known about weather in central Antarctica or central Asia than about that in the South Pacific. The purpose of this paper, therefore, is to describe the weather of the area using the facts which are available, together with reasonable guesses founded on current theory.

There is a very real problem in deciding how to describe the atmospheric circulation of an area which is not characterised by a system determined by ultimate causes but is determined only on the basis of the processes going on within it. Even the broad features of the circulation are the result of the detailed features and vice versa. It is known that the main functions the system has to perform are the transfer of heat polewards and of momentum equatorwards, but the equilibrium thus established is not necessarily uniquely determined. It is proposed to begin with the relatively well-established 'life history' of a depression and its concomitant subtropical features.

THE LOW-LATITUDE CYCLONE

A cyclone often develops in the centre of the southern Indian Ocean and moves to the southeast, increasing in intensity until it is well south of Australia and north of Antarctica where it is then a major storm centre, possibly the most intense on earth outside the tropics.[1] Precipitation changes from rain to snow as the system moves south. The depression may move on to the Antarctic continent, particularly in summer when circulations are slack and surface pressures relatively low. Alternatively, it may be carried to the east by the upper westerlies. In either case, it will be drawing intensely cold air off the ice cap and ice floes in its rear sector and sending it north and northeast. It will also be pulling relatively warm air south in its forward sector, so producing snow on the Antarctic coast. The depression is then likely to drift slowly east, or turn south, and will gradually fill up and occlude.

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[1] W. Schmitt: 'Synoptic Meteorology of the Antarctic', in M. P. van Rooy (Ed.): *Meteorology of the Antarctic*, Pretoria, 1957.

Some features of this 'life history' can be noted. Apart from tiny islands in the oceans, the only land areas likely to be directly affected are Antarctica (and the storm can pass right across the continent in summer), and the southern part of New Zealand. Secondly, because of the lack of relief, there are no preferred 'corridors' for the outflow of polar air. Mixing of air is a much more gradual process than in the northern hemisphere and there are rarely any long northerly trajectories, so that cold air does not reach such low latitudes. There are not the sharp changes in temperature typical of central North America or the China coast, and similar latitudes are warmer 'down under'. Glazed frost, for example, is virtually unknown in New Zealand.[2]

THE SUBTROPICAL ANTICYCLONE TRAIN

Concomitant processes occur further north. Many depressions are linked to troughs of low pressure to the north which separate anticyclones moving to the east. It takes about six or seven days for the ridge and trough to cross any point. Gentilli[3] describes the cycle of weather resulting in Western Australia.

> Thus when an anticyclone is just off the Western Australian coast its first winds will be felt as south-westerlies which come from the sea, and are cool and moist, though usually not enough to be rain-bearing. The anticyclone continues its eastward journey, and gradually passes over Western Australia, with south-easterly winds at first, veering to easterly later, and finally to north-easterly, when the anticyclone has almost completely gone past.
>
> These easterlies and north-easterlies come from the land, and are dry. In summer, they are very hot; in winter they may be very cool.
>
> Since it takes an anticyclone between five and seven days to travel right across Western Australia, this regular veering of the winds takes place within this period, hence the regular weather cycles that may be noticed. An initial south-westerly may bring fresh sea air at 45° or 50°F, to be gradually followed by dry land air at 85°, 90° or 100°F or more after about three or four days, with the highest temperature usually on the fourth day. On the fifth or sixth day the humidity increases and soon the change in the weather takes place, with fresh sea air from the new anticyclone lowering the temperature again. The whole cycle then begins once more.

Clearly, of course, a point in central Australia will experience hot winds from all directions in summer. In South Australia the influence of the change in temperature as the convergence zone passes over is also experienced.[4] On successive days in summer, temperatures can drop by up to 40°F as northerlies from the hot, dry interior change to the cool, moist 'southerly busters'.

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[2] Personal communication, M. A. F. Barnett, Director, New Zealand Meteorological Service.

[3] J. Gentilli: *Weather and Climate in Western Australia*, Perth, [n.d.].

The trajectory of an air stream is particularly important because of the considerable gradient in sea surface temperatures in this area, that is, 9°F between 35°S and 40°S.[5] In April, anticyclones pass to the north of New Zealand, whereas in late summer and early autumn, their centres cross the North Island.[6] In southern New Zealand, where the anticyclones usually pass to the north, there may be only a short break in a dominant westerly circulation, the wind shift coinciding with rain. When the centres pass over northern New Zealand, a slow veering of winds occurs, with quite slack circulations and clear weather as a cell passes over, followed by a sharp shift in winds with, again, frontal conditions. Whether any particular place will gain rain from the convergence zone depends again on the same factors. The eastern lowlands of New Zealand, sheltered by mountains high enough to induce stability by subsidence, gain most of their rain from convergent air coming from the east.

In southeastern Australia, Kraus[7] remarks that west winds have pronounced föhn effects on the eastern slopes of the Australian Alps, especially in winter. In summer, western air is more unstable and showery. There are several notable features of this cycle. It is the dynamic system which is cardinal, not the type of air contained within it, as in many northern hemisphere situations. Temperature changes result from unlike air streams rather than from different air masses.

The Meridional Front

The front which usually occupies the col between anticyclones stretches in a northwest-southeast direction, forming an arc with its southern end at the centre of a high-latitude depression and its northern end diffused in the tropics. It is termed the 'meridional' front by Palmer.[8] Secondary depressions form on this front, generally in the

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[4] G. W. Leeper: 'Climates of Australia', in *The Australian Environment*, Melbourne, 1950.

[5] U. Radok: 'Long Range Forecasting Research in Australia', *Proceedings Pan-Indian Ocean Science Congress*, Sec. A, Physical Sciences, Perth, 1954.

[6] N. G. Robertson: 'Climate', in F. R. Callaghan (Ed.): *Science in New Zealand*, Wellington, 1957.

[7] See E. B. Kraus: 'Secular Rainfall Changes in South East Australia', *Quart. Journ. Roy. Met. Soc.*, Vol. 80, October 1954.

[8] The most comprehensive series of published synoptic charts is in: *New Zealand Radio Meteorological Investigation*, The Canterbury Project, Vol. 2: *Report of Factual Data*, Wellington, 1951.

Tasman Sea area.[9] The depressions usually move southeastwards down the main front, developing in intensity. They affect most of the east coast of Australia, the eastern part of the south coast, the Tasman Sea, New Zealand, and beyond to the Ross Sea area of Antarctica. In their occluded form they can bring rain to most of the tropical area of the Southwest Pacific, bounded to the east by a northwest-southeast line passing near the Society Group. These storm centres may or may not themselves form fronts. According to Kraus, ninety percent of autumn and spring rain in southeast Australia is associated with east-coast depressions with indistinct or non-existing frontal structures.

The line of movement of these depressions is again important in how they affect different areas. In New Zealand, they may bring moist tropical air and intense rain when the eastern sector is passing down the west coast, cold moist air with potentially less rain if the western sector is passing down the east coast, and so on. Blocking situations can occur in which anticyclones to the east of New Zealand stop their eastward movement and cause depressions to lie over the country for several days.

Areas Affected by Cyclones

In the sector of the Antarctic coast discussed so far there are two areas most likely to be affected by cyclones. The first lies immediately to the south of Western Australia, being affected by depressions which move down from the Indian Ocean. The second is the Ross Sea–Adelie Land area which also receives secondary depressions forming on the meridional front. Many depressions, as has been said, simply drift eastwards between 55°S and 60°S in winter and between 60°S and 70°S in summer. A tendency has been noted for a sorting of high and low pressure systems in the centre of the South Pacific Ocean, anticyclones moving to the southeast on to Antarctica, and depressions to the northeast to the tropics. However, it is just as likely for high-pressure systems to join the semipermanent high-pressure area of the eastern Pacific and for cyclones to move over Antarctica. There appear to be relatively few anticyclones in the westerly drift of higher latitudes. Those which occur appear to be the result of wedges of cold air being pulled off Antarctica in the Adelie Land sector. The basic movement of these systems is to the west, with a tendency to equatorward motion.

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[9] J. W. Lillywhite: 'Preferred positions for Cyclogenesis in the Australian and Tasman Sea Area' *Proc. Seventh Pac. Sci. Congress*, Vol. 3, 1949, pp. 48-50 (abstract).

PALMER'S ANALYSIS

The above purely empirical description has, in its major aspects, been known for some time. Palmer not only outlined it clearly in 1942, but attempted an explanation of it.[10] He made the initiating mechanism for most of the weather changes in the Australasian area the development of waves on a quasi-stationary front just east of the African continent. These waves, moving in families in a southeasterly direction, develop into cyclones, and the fronts associated with them occlude. Outbreaks of cold air from Antarctica, moving northwards in the rear of the last member of the family, form anticyclones. A succession of these anticyclones moves across southern Australia separated by occlusions linked to depressions further south. Presumably the earlier depressions of the family have no such lower latitude links in their movement to the east. By the time the Tasman Sea has been reached, and usually earlier, the occlusions have become simple cold fronts. In this area, waves usually form on these fronts, develop into depressions and pass to the southeast.

It may be noted that no appeal is made to upper air conditions except for the general eastward movement, that the low latitude anticyclones are formed from polar air, and that initially the cols between them are occupied by occlusions.

Palmer's reasons for introducing the occlusion into the trough between successive anticyclones may now be examined. In Western Australia a meridional front 'is frequently preceded by high and middle cloud usually moving from the west or northwest, and sometimes as much as 600 miles ahead of the front', and rain can occur in advance of the front. Again in the same region, an occasional cycle of events is for northeast winds to shift to northwest with a rise in dewpoints and sometimes rain; the wind then shifts to southwest, dewpoint falls and rain occurs. All these features can be explained by reference to a wave in the upper westerlies.

WAVES IN THE UPPER WESTERLIES

A later work, with which Palmer was probably associated, draws on the findings of Riehl in the northern hemisphere, and the westerly complex described above is related to waves in the upper westerlies.[11]

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[10] See C. E. Palmer: 'Synoptic Analysis over the Southern Oceans', *N.Z. Met. Off. Prof. Note No. 1*, Wellington, 1942.

[11] See 'Southern Hemisphere Synoptic Meteorology', in F. A. Berry, E. Bollay and N. R. Beers (Eds.), *Handbook of Meteorology*, London, 1945.

These develop near the west coast of Australia and dissipate south of Tahiti. The surface low pressures of high latitudes (presumably the depressions at 60°S) are continuous with pressure troughs in the upper westerlies at lower latitudes. These again are continuous with surface low pressures at these latitudes, the upper trough, however, being considerably in advance of the surface features. (See Figure 1.) A point stressed in this work is that Antarctic air rarely, if ever, moves out from the continent in great outbursts, there being rather a gradual mechanical mixing in a dominantly westerly wind system.

It is clear that Palmer's idea of an occluded front over Western Australia can be discarded. That the migratory anticyclones are necessarily composed of Antarctic air is also doubtful. Palmer gives an example of such an occurrence, but Gibbs,[12] on the other hand, believes them to originate from a cellular division of the semipermanent anticyclone of the eastern Indian Ocean. Hogan[13] gives generalised charts of this process. If the fact of a wave in the upper westerlies with its concomitant sectors of convergence and divergence be accepted, there seems no reason why anticyclones cannot be formed in any type of air. As has been pointed out, there is very little airmass differentiation in this area.

The exact process by which the surface waves of the Indian Ocean are linked to the waves in the upper westerlies is not clear from the report of the Institute of Tropical Meteorology.[14] If, as is stated, the waves aloft do not develop until the west coast of Australia is reached, it would appear that the surface waves are regarded as the initiating mechanism. It would seem much more logical, however, to have the upper waves as triggering the Indian Ocean cyclones. As will be seen later, there is no need to specify an origin to moving ridges and troughs in the westerlies.

Perhaps a closer investigation of the relations between upper and surface features is in order. Any disturbance in the upper westerlies will produce an undulation in the horizontal plane, with the axes of the ridges and troughs pointed northwest-southeast. The winds of the ridges have anticyclonic curvature, those of the troughs, cyclonic curvature. The ridge and the long preceding sector after the trough have diverging, subsiding air; the trough and the short sector following

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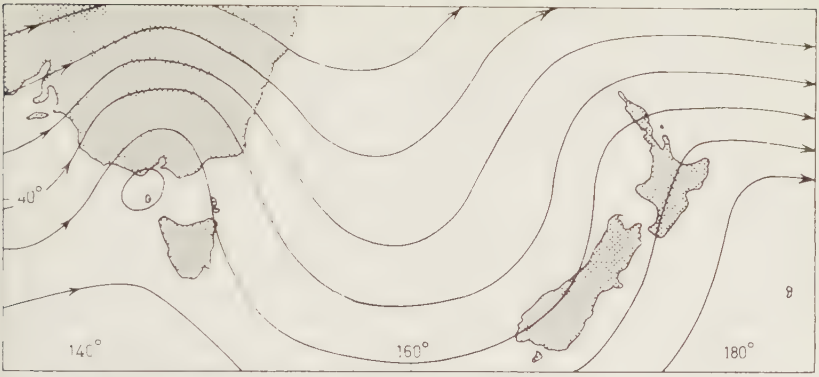
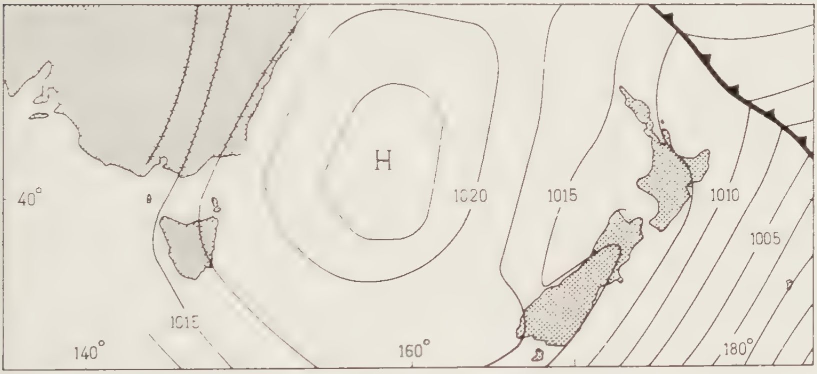
[12] W. J. Gibbs: 'Synoptic Analysis over the Tropical South-West Pacific Area', *Commonwealth Met. Bur. Bull. No. 30*, Melbourne, 1943.

[13] J. Hogan: 'Meteorology of the Indian Ocean Area between Western Australia and India', *Bull. No. 40*, Meteorological Branch, Dept. of the Interior, Australia, 1948.

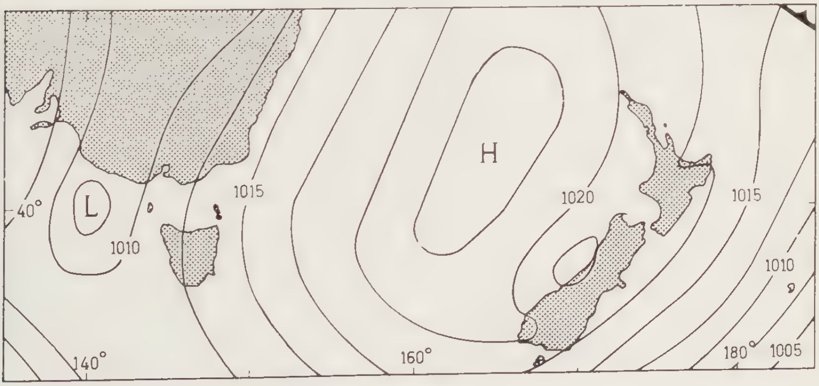
[14] 'Southern Hemisphere Synoptic Meteorology', *op. cit.*



UPPER AIR STREAM LINES, 0400 GMT, 15-10-1953



LOWER AIR ISOBARS, 0400 GMT, 15-10-1953



LOWER AIR ISOBARS, 1600 GMT, 16-10-1953

Fig. 1. Upper air stream lines and lower air isobars in the Southwest Pacific. Upper air chart from J. F. Gabites: 'The Drift of Radioactive Dust from the British Nuculear Bomb Tests in October 1953', *N.Z. Journ. Sci. & Techn.*, Sect. B., Vol. 36, No. 2, Sept. 1954. Lower air charts from Auckland newspapers the ridge have converging, ascending air. Thus relatively long spells of fine weather broken by shorter periods of rain result.

Mean Convergence and Divergence Zones

So far discussion has been confined to the planetary waves of the westerlies migrating downstream. There are, however, preferred zones for the location of troughs and ridges so that they may be regarded, in the mean, as semipermanent in those positions. In the area under consideration, ridges occur frequently over the Andes as well as in the Australia–New Zealand area. Troughs have mean positions in the central Indian Ocean and the central South Pacific. Lamb[15] suggests that the reasons for these locations are thermal, and instances the Indian Ocean trough as being north of the great mass of western Antarctica with its intense radiational cooling. Hofmeyr[16] links the Pacific trough to the low pressures of the tropical Pacific. On the other hand, it appears possible that the Andes, in deflecting the westerlies, produce divergent flow on and to the windward of the ranges. This could presumably set up standing waves around the latitude circles.

Figure 2 attempts to show the zones of divergence and convergence associated with the troughs and ridges.[17] Also shown is the extreme northern limit of pack ice which corresponds closely to the line of convergence between polar and subtropical seas.[18] These zones are of great interest and do much to explain what was previously known empirically. The cyclone developing in the centre of the South Indian Ocean, with which the present description began, can be seen as related to the mean convergence zone there. A similar breeding ground in the central Pacific is the beginning of another train of depressions passing on to Antarctica via the Bellinghausen Sea or into the South Atlantic via Drake Passage. Whether in fact new depressions commence here, or whether some old ones are reactivated, is not really important. Certainly an anticyclonic cell has been traced most of the way around the globe from South America to New Zealand.[19] The southeasterly movement of cyclones can be related to the steering action of the northwest upper winds in the sector between the trough and ridge axes.[20] Comparison of this map with that of average annual rainfall (*Fig. 3*) shows a close correspondence between mean divergence and lower rainfall.

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[15] H. H. Lamb: 'The Southern Westerlies; A Preliminary Survey', *Quart. Journ. Roy. Met. Soc.*, Vol. 85, January, 1959.

[16] W. L. Hofmeyr: 'Upper Air over the Antarctic', in *Meteorology of the Antarctic*, (*op. cit.*).

[17] Lamb (*op. cit.*) has drawn pressure profiles for various southern latitudes from which these zones were estimated. G. A. Dean's streamline analysis of surface winds for the northern hemisphere autumn (presented in C. E. Palmer: 'Tropical Meteorology', in *Compendium of Meteorology*, 1951) was also used for the mid-Pacific.

[18] J. J. Taljaard: 'Geographical and Hydrological Features of the Antarctic', in *Meteorology of the Antarctic* (*op. cit.*).

[19] Schmitt: *op. cit.*

THE GENERAL CIRCULATION

The current picture of the general circulation[21] as developed from northern hemisphere data and stated in the simplest terms is of a belt of upper westerlies in mid-latitudes flanked on either side by easterlies. These westerlies develop waves which result in complex secondary circulations within them and below them and which effectively mix the air. This results in: (i) one or more sharp zones of maximum wind velocity in the upper westerlies—the jet stream(s); and (ii) the destruction of temperature gradients south of the jet and their concentration under the most poleward of these jets. North of the jet there will be a narrow zone of subsiding, diverging air within the westerlies. The meanders of the jet and, quite often, the development of cutoff circulations (anticyclonic polewards and cyclonic equatorwards) allow the transfer of both warm and cool air. There is no need to appeal to local causes or to local energy sources for the meanders in the jet and the resulting secondary circulations. Any wave anywhere will result not only in the simultaneous development of waves dispersed fairly uniformly in all longitudes, but also in the supply of energy for their development. Finally, there is believed to be a cycle lasting four to six weeks. It begins with the period when the jet and the temperature discontinuities under it (the polar front) and the secondary circulations are most intense. Then follows a period when lateral mixing is reduced and differences in the radiation balance in the different latitudes lead to a thermal gradient developing along the meridians. The jet stream zones are now at their weakest, and direct meridional circulations may assume importance. The upper westerlies are restored, secondary circulations reactivated, and the cycle is completed.

The middle and high latitudes of the southern hemisphere differ from those in the northern in several important respects which are likely to change some features of the generalised picture above. The only continent in this zone comparable with the high-latitude masses of North America and Asia is Antarctica, eccentrically centred on the

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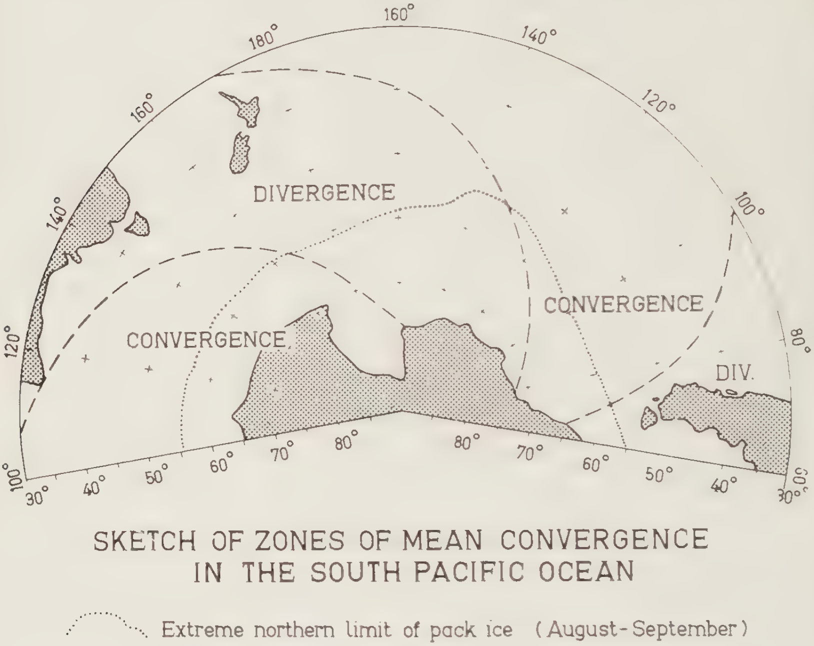
[20] Lamb: *op. cit.*

[21] See C. G. Rossby: 'On the Nature of the General Circulation of the Lower Atmosphere', in *The Atmospheres of the Earth and Planets*, G. R. Kuipe (Ed.), Chicago, 1952.

South Pole and surrounded by wide expanses of ocean save for Drake Passage to the south of South America. Secondly, apart from the Andes–Grahamland mountain ridges, there are not the series of ranges trending north-south that are found in the northern hemisphere.

Thus conditions are not present for a comparable distortion of the upper waves nor for friction to the movement of cells in the westerlies, or, indeed, for friction to the flow of the winds. Large snow-covered surfaces do not exist to slow down and halt the movement of anti-cyclones. The equatorward movement of polar air is not prevented to any extent, so that there is a slow general export rather than the huge surges down preferred corridors as in the northern hemisphere. There is no 'polar front' equivalent to that of North America or China. It seems likely that the cycle between meridional and zonal flow is not nearly so pronounced nor so regular, but the fact that high-latitude cyclones occur in 'families' followed by a lull suggests that there is an oscillation in 'index' conditions. The cycle is thus between weak and intense zonal flow, with meridional flow occurring only occasionally and only in restricted sectors.


160°
180°
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160°
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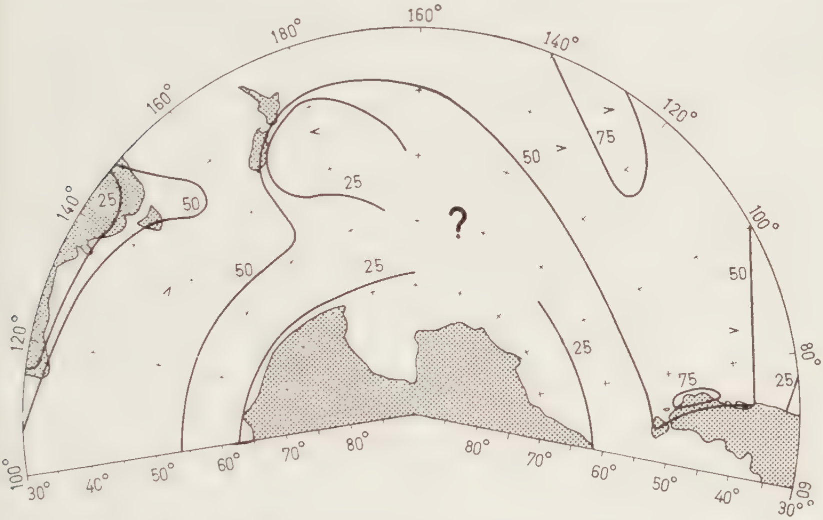
DIVERGENCE
CONVERGENCE
CONVERGENCE
DIV.
30°
40°
50°
60°
70°
80°
80°
70°
60°
50°
40°
30°
SKETCH OF ZONES OF MEAN CONVERGENCE
IN THE SOUTH PACIFIC OCEAN
Extreme northern limit of pack ice (August-September)

Fig. 2. Zones of mean convergence in the South Pacific

JET STREAMS

The jet streams of the Tasman are rather different from their counterparts in the northern hemisphere. The subtropical jet has its maximum speed at an elevation of approximately twelve kilometres, this being about 50–60 knots in summer at about 33°S, and more than 100 knots in winter at 25°–28°S.[22] Lamb puts the jet much further south in summer, 'perhaps as far as 40°–45°S'. It is not 'merely a statistical abstraction but a feature of almost any high-level winter synoptic chart'.[23] The migratory anticyclones are centred under it, and cyclonic activity is controlled to a considerable extent by variations in its track and intensity.



MEAN ANNUAL RAINFALL IN INCHES

Fig. 3. Mean annual rainfall in the South Pacific

Whether there are one or more jets in higher latitudes, as in the northern hemisphere, is not known. Gibbs remarks that a secondary maximum of speed in the mean circulation is suspected at about 60°S at a height of 300–400 mbs in summer, and in winter it is likely to exist at 70°S. Since the conditions which lead to the establishment of the northern hemisphere counterpart are largely reproduced in the south, it seems probable that they do in fact occur. Certainly lateral mixing is at least as intense as in the northern hemisphere and this should mean a strong jet.

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[22] For mean cross sections in the Tasman area see J. W. Hutchings: 'A Meridional Cross Section for an Oceanic Region', *Journ. Met.*, April, 1950; and F. Loewe and U. Radok: 'A Meridional Aerological Cross Section in the Southwest Pacific', *ibid.*, Vol. 7, 1950, pp. 58–65. See also W. J. Gibbs: 'A Comparison of Hemispheric Circulations with Particular Reference to the Western Pacific', *Quart. Journ. Roy. Met. Soc.*, Vol, 79, January 1953, for mean cross sections for the southern hemisphere.

[23] J. W. Hutchings: 'Meteorological Progress', in *Science in New Zealand* (*op. cit.*), pp. 26–35.

Antarctica

It will have been remarked that the statement above has regarded Antarctica as essentially passive in its effect on the circulation pattern. As Priestley put it, observations made at its coastline 'play a part analagous in many respects to that of the boundary condition in problems of mathematical physics'.[24]

In general, the circulation of air over the Antarctic continent has relatively little effect on land areas further north,[25] although it is far from being a closed system in the Hobbs sense. There is not only meridional exchange near the surface via the movement of depressions on to the continent—and some of these may recurve on to the sea again—as well by outbreaks of cold air out of the continent, evidently provoked by depression pressure patterns, but also there is interchange aloft.

The most usual situation over Antarctica is one of slack pressure gradients with both anticyclones and cyclones appearing at the surface. The cyclones will usually have originated in lower latitudes, but occasionally 'cold depressions' formed aloft in winter may reach the ground. Coastal depressions may on occasion be so intense as to leave no room for anticyclones. These latter systems are most common and most intense over eastern Antarctica, but such a position is not permanent. Little can be said of upper-air conditions at the present time.

The Southeastern Area of the Pacific

In the western sector of the South Pacific Ocean, which is fairly well known, circulations can vary widely. In the eastern sector for which only scanty information is available, a fairly stable synoptic pattern has been implied in this article. Palmer, for example, regards the tropical anticyclone and its northern outflow of low-level easterlies as a highly stable feature.[26] This simplicity is more likely to be a product of ignorance, however. Schmitt, for example, remarks that synoptic patterns can vary widely over the southeastern Pacific Ocean.[27] At the present time only the broad outlines may be sketched in simple terms. This area should be analagous to the Western Australia sector, with the difference that South America projects further south and is higher. The land area thus receives more rain from depressions originating in the Pacific convergence zone. The rains of the 'mediterranean' region of Chile show that the semipermanent anticyclone must be well to the north in winter; and Flohn reports that westerly storms may reach to the Tropic of Capricorn.[28] Nevertheless, this sector of the southern hemisphere is the most likely of any to experience a single high-pressure area stretching from pole to tropics. This will occur when outbreaks of polar air, produced by west-moving depressions, join up with the tropical anticyclone so that a direct meridional circulation could develop. This would correspond to a blocking of east-moving cells.

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[24] C. H. B. Priestley: 'Air Circulation and the Antarctic', *Aust. Journ. Sci.*, Vol. 10, No. 5, April 1948, pp. 129-31.

[25] Basic references on Antarctic meteorology in addition to those already mentioned are: A. Court: 'Antarctic Atmospheric Circulation', *Compendium of Meteorology* (*op. cit.*) pp. 917-41; G. P. Britton and H. H. Lamb: 'A Study of the General Circulation of the Atmosphere over the Far South', *Weather*, September 1956, pp. 281-291; November 1956, pp. 339-353; *idem.*: 'General Atmospheric Circulation and Weather Variations in the Antarctic', *Geog. Journ.*, Vol. 121, Pt. 3, September 1955, pp. 334-349; C. S. Ramage: 'The Atmospheric Circulation of the Ross Sea Area', *N.Z. Met. Off. Prof. Note No. 2*, 1944; and H. Wexler and M. J. Rubin: 'Antarctic Climatology and Meteorology', in *Antarctica in the International Geophysical Year*, 1956.'

Conclusion

Apart from the Antarctic continent and small-scale 'rain shadow' areas it is difficult, if not impossible, to distinguish subareas within the general region of this survey in terms of their genetic weather processes. There is a north-south temperature gradient which could be arbitrarily split up, but there is no advantage in doing so. Records may perhaps accumulate so that, some day, frequencies of types of isobaric curvature can be correlated with rain records, and areal differences recognised. At the present time, some differences may be noted in a vague qualitative fashion. However, the really remarkable characteristic is the overall homogeneity of process in the area, particularly when contrasted with the tropical and subtropical areas further north. It appears that sharp climatic gradients in temperate and polar regions are the consequence of landform differences, a feature which is not true of the tropics.

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[26] Palmer: 'Tropical Meteorology', *op. cit.*

[27] Schmitt: *op. cit.*

[28] H. Flohn, quoted in Lamb: *op. cit.*

MIRROR FOR NEW ZEALANDERS:

A DESCRIPTIVE ATLAS REVIEWED

THE PUBLICATION of a national atlas is an event always eagerly anticipated, particularly, when, as in New Zealand, the occasion has been in the making for more than twenty years. First proposed as a centennial publication to appear in 1940, and then, in the postwar period long referred to as the 'historical' atlas because its preparation fell to the Historical Branch of the Department of Internal Affairs, the so-called national atlas finally appeared in November 1959 under the title of *A Descriptive Atlas of New Zealand.*[1] Intrinsically it is well worth the modest price asked for it, and the format, typography and quality of reproduction reflect the skill of the editor, Dr A. H. McLintock, the Parliamentary Historian. He is to be congratulated on what he has made of the material available to him.

Yet the question does immediately arise as to the purpose of the atlas. As reference material in a university library it is sadly lacking; as a school atlas it may find limited use in the fifth form—and perhaps in the sixth; but as an adjunct to household or office, or as a gift for friends overseas it is most probably best suited. In short, those who expected a national atlas in the sense of the ideas first mooted—something comparable with the *Atlas de France* or the *Atlas of Australian Resources*, even on a reduced scale—will be disappointed, particularly when they remember the high hopes with which the project was first undertaken and the vast amount of research which distinguished the preliminary work. As it stands, this atlas, had it been published twenty years ago would have, in the words of the foreword, 'compared favourably with any similar overseas publications' but now it must rank merely as a very useful and colourful extension of the annual official yearbooks of the dominion.

Some Major Defects

The atlas comprises forty-eight pages of coloured maps—the 'atlas proper'—eighty-eight pages of text, twenty-five half-tone illustrations each occupying a full page, and twenty-one pages devoted to a gazetteer. The endpapers display the Laurie and Whittle map of 1800 depicting the voyages of Captain Cook—a map which deserves a better fate than to suffer probable defacement at the hands of a librarian busily sticking labels—whilst the dust jacket is nondescript and is better discarded in favour of the pleasantness of an excellent binding.

Yet it is this very binding that provides a major source of criticism. Surely it is appreciated that any national atlas, if it is to be such, needs constant revision, and that this is achieved much more readily when only single sheets are concerned. Moreover full binding means that pages do not lie flat—an unfortunate circumstance which detracts from the value of the seven double-spread topographic maps on the scale of

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[1] A. H. McLintock (Ed.): *A Descriptive Atlas of New Zealand*, Wellington, Government Printer, 1959, price 40s.

1 : 1,000,000, particularly when, as in the case of Northland, most of the land area falls within the inner halves of the pages. In the same way the ingenious oblique Hammer projections computed by L. P. Lee lose much of their point because New Zealand relationships with the Pacific island world are difficult to visualise.

Generally speaking, however, the maps in the atlas reflect a high standard of draughtsmanship and reproduction, although there will be some who will object to the restrained use of colour. The maps are indeed fine examples of the modern cartographer's art, and the Surveyor-General is to be congratulated on the technical achievement of his staff, even though they have fallen from grace a little on the matter of consistent colouring of Lake Taupo and Kaipara Harbour on the maps of climate (Nos. 8 and 9). The physical map (Nos. 6 and 7) is undeniably among the finest of New Zealand yet produced, although its layout demonstrates one significant fault—the placing of the North Island to the left of the South Island in adjacent maps each occupying a full page. In reality the latter island lies to the west of the former, and a more readily appreciated juxtaposition would be achieved if the South Island were shown on the left-hand page. Moreover, the outline of the northernmost part of the South Island should always appear on the map of the North Island in order to demonstrate the relative positions of the two islands. In only one instance is attention paid to this last point—in the physical map—but then, as has been stated, the layout of the two pages is faulty. (In passing it may be noted that, in the outline map illustrating the distribution of fish on page 49, part of the Taranaki coastline has been omitted—an unimportant blunder, as it so happens, but one which should have been noticed and corrected.)

Another criticism of the page-size maps of each island is the peculiar choice of scale. That approximately fifty miles are represented by one inch possibly influenced the choice of 1 : 3,200,000, but maps on the natural scale of 1 : 3,000,000 could have been easily accommodated on the page. The choice is even more confusing when it is seen that the maps of communications (Nos. 24 and 25) have been drawn at 1 : 6,000,000 instead of 1 : 6,336,000. But perhaps consistency was not a major consideration when these maps were prepared.

The Topical Maps

Seriatim much could be said about each map in the atlas, but limitations of space preclude extensive comment. The maps of climate are surely deficient in that lines of latitude are not shown, whilst that of geology (Nos. 10 and 11) is more than adequate in its detail. The geological map, however, is possibly a little bewildering to the layman, and perhaps space could have been found in the text for a more simple and appealing division into metamorphic rocks and hard sedimentaries, softer tertiary sedimentaries, recent deposits, and volcanic rocks. The soil map (Nos. 12 and 13) is also complex, but, as with the geological map, fine printing has rendered it very legible. The classification employed is similar to that published by the Soil Bureau in 1948, with some important revisions, especially of the so-called 'skeletal' soils.

Perhaps the most original contribution in the atlas is the map of pre-European vegetation (Nos. 14 and 15). This may be regarded as the distillation of research carried out during the past decade by officers of the New Zealand Forest Service and of the Botany Division and Soil Bureau of the D.S.I.R. It will supplant Cumberland's map which appeared in 1941,[2] and comparison of the two publications leaves one with a sense of admiration for Cumberland's effort of nearly twenty years ago. However, now, for the first time, short and tall tussock grasslands are differentiated, and beech forest is delimited.

The map of land classification (Nos. 18 and 19) is most ingenious, fifty-seven categories being shown without undue confusion. Unfortunately the full key has, perforce, been relegated to the text, and consequently the layman may find the maps rather overwhelming. Nevertheless, the result, even with the abbreviated key is most comprehensive and provides both a contrast to, and a comparative basis for, the map of land utilisation that follows (Nos. 20 and 21). This map is disappointing, both in the choice of colour and in the overgeneralisation that derives from the adoption, in major part, of types of farming for classes of land utilisation. The blues used to depict extensive and semi-extensive types of farming are not clearly distinguishable from that of the sea, and both are easily confused with the grey used to denote undeveloped land, scrub and native forest. The grouping together of these last three suggests that a land-use map[3] would have been of greater interest and of equal merit. On points of detail it may be argued, with some justification, that the map, as drawn, is inaccurate, and certainly there is no reason at all for the 'rounding-off' of the boundaries of the exotic forests on the Volcanic Plateau.

The map of manufacturing (Nos. 22 and 23) is interesting enough, but more useful would have been a map or maps showing the distribution of factories and plants, the numbers of workers employed, and other features. Has bureaucracy so fettered itself with census-like secrecy that the mapping of such features has become impossible—and, if so, to what purpose? In any case the boundaries of employment districts bear no relation to any other statistical boundaries in New Zealand, and consequently strict correlation of manufacturing data with other significant geographic elements is impossible. The maps of communications (Nos. 24 and 25) are adequate, though out of date on small details.

Topographic Maps

The topographic maps (Nos. 26 to 39) are in effect a dissected version of the 1 : 1,000,000 map already published by the Department of Lands and Survey. To have them in so handy a format is recommendation enough—except for the fact that they cannot be easily read at the bound edge of the pages, despite the perfect registration. Cartographically the maps are in impeccable taste, and are excellent for locality reference, although some users might wish for a fuller naming of mountain peaks. Eighteen inset maps of the scale of 1 : 75,000 show the street patterns of the built-up areas in all towns of more than 8,000 inhabitants. Though useful for comparative purposes, these town maps lack detail and are rather uninteresting.

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[2] See K. B. Cumberland: 'A Century's Change, Natural to Cultural Vegetation in New Zealand', *Geog. Rev.*, Vol. 31, No. 4, October 1941.

[3] A differentiation of land use and land utilisation is implied. A map of land use would show the actual use to which the land is put in terms of its natural and cultural vegetative cover, whereas one of land utilisation would portray how that vegetative cover was utilised. 'Land use' is a formal concept, 'land utilisation' a functional one.

Maps of the four metropolitan areas each occupy a full page on the scale of 1 : 100,000, and are therefore comparable, even if Metropolitan Auckland has of necessity, been truncated in the south at Otahuhu and at Panmure in the east and Glen Eden in the west. Consequently much of the rapidly expanding urban fringe of Auckland with its residential and industrial development is omitted—although so are the coastal dormitory settlements of Metropolitan Wellington north of Paremata. Perusal of the map of Auckland (No. 40) raises two interesting points. First, as a matter of cartographical ethics, should the northern motorway through Albany be shown as completed—or if it were the intention to anticipate events and facts, should the vehicular ferries be shown in operation on the same map, since the opening of the harbour bridge preceded even the construction of the motorway? The fact that neither the motorway nor the ferries now exist renders the map inaccurate. Second, on this map only of the metropolitan group is a double-track railway shown by two lines. Apart from any consideration of consistency, this rare phenomenon in New Zealand surely merited the cartographer's attention in the other main centres.

Finally, one may cavil at the use of the term 'provinces' on the maps of administrative divisions (No. 48). The relevant map depicts the boundaries of the provinces at the time of their abolition in 1876, and although the areas have had legal status as provincial districts since then, they are no longer administrative divisions. On the other hand if it were intended that these boundaries should be shown as historical features, it is anomalous to omit the Southland Province which existed from 1861 to 1870.

Text and Textual Maps

The text section of the atlas embraces descriptive matter, twenty-five line maps, and seventeen graphs and cartograms. The development of the material is around the coloured maps of the 'atlas proper', with significant additions on the Maori, the discovery and early colonisation of New Zealand, the seas around the dominion, the fauna, mining, power utilisation and tourism. Some of the maps in these various sections would have provided interest and instruction had they been incorporated as coloured versions and their scope widened. Others, in their present form, would have been better omitted. A major fault is the omission of dates on the maps of manufacturing (p. 61), distribution of sheep (p. 40) and distribution of dairy cows (p. 42). This last map is remarkable in that only the North Island is shown. Ten percent of the dominion's dairy cows are found in the South Island and their distribution there is as significant as in the North Island, for blank spaces on dot maps are as notable as those spaces where the symbols coalesce and numbers cannot be readily gauged. A similar deficiency occurs on page 73 in maps of the Maori population in 1926 and 1956. However the major fault in these maps is that the dot representation is too great and consequently it is difficult to demonstrate with any degree of precision the actual distributions, with the result that it is not easy to appreciate changes that have taken place.

The map of mineral resources (p. 51) is disappointing also, for the symbols have not been wisely chosen and the areas of some coalfields have been grossly distorted. In the section on transport and communications the maps are too small—especially when compared with the map of pre-European Maori population which occupies the whole of the third page. Finally, the cartograms relating to imports and exports (p. 66) are of little value since the precise information is given in tables on the same and adjacent pages.

However, although one may look in vain for the cartographical representation of important features like hydroelectric-power stations, and for lesser items like the quantities of fish landed at ports, interesting and useful information is embodied in the text. The section on soils and land use is one of prime importance, whilst that on the land-classification map contains a wealth of valuable fact and opinion. By contrast the sections on trade and commerce and on transport and communications are trite and uninspiring. One is tempted to believe that in certain quarters there was little enthusiasm for the chore of writing up the material for the atlas, and that when the labour was undertaken willingly, it was with a fervour that led to something beyond the power of the average layman. Perhaps, when the occasion next arises, copy might be prepared with the readers in mind and not as a departmental exercise.

That part of the text which describes the landscapes depicted in the sectional maps on the scale of 1 : 1,000,000 has suffered from undue condensation and is marred by infelicity of expression and meaningless phrases. What are 'overseas standards' in the classification of plain in New Zealand? Have westerley *winds* 'caused a smoothing of the outlines of the west coast' of North Auckland? Is dairying spreading *down* the Bay of Plenty, and does the main road northwards from Waiouru run *across* the Desert Road? And what is a 'close pattern of settlement names'? Apart from lamentable slips such as these, this section is generally disappointing, for an opportunity has been lost to present something of the characteristic variety of the New Zealand landscape—the changing facets of the countryside that derive from the significant combination of physical and human features. As it is, the physical aspects are given emphasis—even to a map of physical regions to which the reader is never referred.

The Illustrations

The illustrations consist of oblique aerial photographs which are excellent in themselves and which have been reproduced extremely well. They unfold a splendid record of the New Zealand landscape, and one cannot but admire the temerity of the chooser and applaud the choice of the one used as a frontispiece to illustrate an epitome of the dominion's countryside. The selection of these illustrations could not have been easy, but it is questionable whether the Waikato and Northland should have been omitted when five photographs of the Volcanic Plateau and its margins and two of Mount Cook are included. Again the question arises as to the purpose of the atlas, and again the fact is patent that it has not a national coverage. Moreover even some of these photographs are out of date, that of Wellington being obviously old. Possibly the flight was made on a Sunday, and this would explain the lack of busy traffic which characterises all metropolitan centres in New Zealand, the capital in particular, but the presence of the veteran liner alongside Glasgow Wharf suggests that this particular view is at least ten years old. So rapid are the changes now taking place in many parts of New Zealand, and in Wellington and Auckland especially, that, as with statistical maps, some indication must be given of relevant dates.

In all, then, *A Descriptive Atlas of New Zealand* may be considered to be a curate's egg. The parts that are good are worthy of the highest praise, and certainly the printing, binding and general bookmanship reflect great credit on those responsible. This atlas must be the most exquisitely produced book that has passed through the office of the Government Printer. The editor, too, despite the problems he has obviously had to face, has played his part well, although apparently, because of departmental insistence, he has not been able to achieve consistency in the use of 's' and 'z' in such words as 'utilisation'. At times he has allowed typographical errors to creep into the text—the misspelling of Lyttelton on page 79, for example—and has not seized upon conflicting usage by his authors—Tutamoe Plateau and Tutamoe Range being a case in point.

The parts that are bad could, to a degree, be corrected when the atlas is reprinted, but worthwhile improvement would come only with a complete recasting of the material, with the rewriting of large sections, and with a more positive attitude to what the purpose of the atlas should be. If such reorganisation is acceptable—and it must be if the atlas is to have any status as a national atlas—consideration ought to be given to the publication of maps on loose leaves, each map or series of maps being accompanied by an explanatory text; and there should be a complete coverage of all facets of the New Zealand life and economy. A national atlas of these dimensions would, as a matter of course, include historical material, and the results of research already undertaken with this in view would finally see the light of day.

Higher Aspirations

Eight years ago,[4] we had occasion editorially to express alarm at the apparent demise of the atlas project. Early in 1954 an advisory committee was set up to help in the carrying out of a scheme to publish a descriptive atlas, and to this committee the New Zealand Geographical Society sent a representative. The fact that the present publication does not receive the unrestrained plaudits of academic geographers suggests that perhaps the committee, in its planning to meet the needs of professional users, schoolteachers and laymen, fell between the three stools. Yet because the first edition was sold out, it might be argued that the layman found the atlas useful, and because a copy is to be sent to each school in the dominion, it could be said that schoolchildren will benefit. We suggest that the layman knows a bargain when he sees one—especially of books in good taste—and that schoolchildren will be happy to see the atlas on the shelves of the school library. If greater and wider use of the atlas is to be made, if it is to be a national atlas comparable with its counterparts overseas, a more lofty purpose must be envisaged and greater care must be taken to ensure that the publication is worthy of the company in which it will find itself.

—The Editors

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[4] See 'Geographic Notebook', *N.Z. Geographer*, Vol. 8, No. 2, October 1952, p. 171.

GEOGRAPHIC NOTEBOOK

IN THIS ISSUE. The four main articles in this number of the *New Zealand Geographer* have been written by members of university staffs. Mr C. J. Burrows, Lecturer in Botany at the University of Canterbury, has recorded some of the results of his research into the nature of the vegetation of the Canterbury High Country. His account of the changes that have occurred in the Cass area completes a trilogy of investigations—reported in this journal—begun by Mr W. P. Packard in the Lake Coleridge catchment, and continued by Mr D. H. Relph in the Castle Hill Basin.

Dr L. Curry, until recently Lecturer in Geography at the University of Auckland, in his description and interpretation of the atmospheric circulation in the southern part of the South Pacific attempts to elucidate some of the problems which beset climatologists in New Zealand. Dr Curry left Auckland in February for Europe and North America and will eventually take up a post in the University of Maryland. Mr R. G. Ward, also Lecturer in Geography at the University of Auckland, is engaged in research in Fiji, and the present article represents one of a series on population and resource problems in that territory.

The contribution of Mr R. P. Hargreaves, Lecturer in Geography at the University of Otago, is an exercise in historical geography—of the period about 1867, the 'golden age' in New Zealand history. His article, at the present time, is apposite, for it was in 1867 that the *New Zealand, Its Physical Geography, Geology and Natural History* of Ferdinand von Hochstetter was published in an English edition. In essence, then, the New Zealand that Mr Hargreaves describes is the New Zealand that Hochstetter knew and which he portrayed with so skilful a pen that his account is even today exciting and memorable.

Hochstetter arrived in New Zealand late in 1858 and returned to Austria early in 1860, so that the year 1959 effectively marks the centenary of Hochstetter's travels in this country. It is hoped that, in a subsequent number of the *New Zealand Geographer*, some recognition of this event can be made and so supplement in detail the general observations of Mr Hargreaves. Meanwhile the *New Zealand Journal of Geology and Geophysics* has made its contribution in the form of a centenary issue, and the Government Printer has just published Hochstetter's *Geology of New Zealand*, translated and edited by Dr C. A. Fleming of the Geological Survey. This book is commented upon in the review section which follows.

The New Zealand centenary of Hochstetter's visit is aligned, remarkably enough, with similar celebrations in Germany associated with Carl Ritter and Alexander von Humboldt, the giants of the classical period in the history of geography. Hochstetter himself quotes Ritter as saying in 1842 that New Zealand seemed 'destined before all other countries to become a mother of civilised nations'. The discernment of this statement is noteworthy, but it is questionable even now, more than a hundred years later, if the prophecy is likely to be fulfilled except in terms of material wellbeing.

The index for Volume Fifteen of the *New Zealand Geographer*, which accompanies this issue, has been prepared by Mr L. S. Suggate of Christchurch.

DUMPING AND DIVERSIFICATION. Most New Zealanders envisage European states as countries which have a far higher demand for agricultural commodities than can be supplied from their own farms. This is often not true, and it is the dumping of surplus agricultural products on the English market which severely threatens the export trade of New Zealand. The creation of surpluses, particularly of dairy products, by countries which are primarily industrial is often attributable to tariffs and quotas designed to protect domestic agriculture. Subsidies have been introduced also in order to give farmers incomes which are similar to those of industrial workers. These factors, among others, give rise to situations where conditions other than demand influence supply, and surpluses are often produced. Such problems lay at the root of the discussions between the governments of New Zealand and the United Kingdom during 1959, and along with 'the case for diversification' in New Zealand's dependent agricultural economy, are the major topics in the report of the Director-General of Agriculture which serves as the introduction to the latest annual *Report of the Department of Agriculture.*

Mr Smallfield warns against an inclination to rush hastily into a more diverse farming economy. He concludes that 'our best course is to adhere to low-cost grass-farming methods, make our system as flexible as possible within the limits of grass-farming, but avoid hasty changes in response to short-term demand'. In order to diversify farming in New Zealand within the prescribed limits, he suggests that 'we should endeavour to pay more attention to beef production, but this is essentially a matter of increasing overall carrying capacity, and particularly the provision of winter feed on sheep farms for beef cattle'.

Apart from this introduction, a mention of FAO and a more detailed reference to the quality of New Zealand products marketed in the United Kingdom, there is no mention of oversea trends in farming and marketing, and no note regarding the reception of New Zealand products. Although such a commentary might legitimately be considered to be outside the scope of this report, the importance of these factors, especially in the light of Mr Smallfield's introduction, warrants the inclusion of a longer reference to trends which might have a direct influence on New Zealand's agriculture.

Of interest is the discussion of weather conditions, pastures, crops and livestock in four major areas in New Zealand during 1958–1959; but much of the remainder of the report is taken up with references to the manifold activities in each of the five major divisions of the department, including fairly full reports on research projects. Although, to judge from the report, research in some agricultural sciences is flourishing, no assessment is made of regional variations in agriculture nor of the total character of various types of farming, and only one reference is made to research projects designed to comprehend such differences. The value of such assessments, based on census returns and similar surveys, as an aid to understanding diverse national and regional agricultural problems, has already been ascertained in the United States where type-of-farming regions provide a basis for correlation of the many features concerned.

This New Zealand report emphasises departmental activities, and while one must admire the department's keen interest in a wide range of research projects, it is disappointing that more research, which would be discussed in the report if it were being carried out, has not been done on land-use and management as related to other economic and physical factors. However, reference is made to the collection of management and accounting data from representative groups of farmers so that 'it will be possible to establish economic and physical standards of the main *land classes*'. For many years now geographers have urged the need for completely integrated land-use studies as a basis of future agricultural planning in New Zealand. The present proposal has intrinsic value, but much more could be done if the Department of Agriculture, the Department of Lands, the various planning authorities and other interested organisations, together with university geographers, could combine their resources and their efforts.—IAN POOL

NEW ZEALAND GRASSLAND ASSOCIATION CONFERENCE, 1959. The twenty-first annual conference of the New Zealand Grassland Association was held in Gisborne early in December 1959. A field excursion was held and fourteen papers were presented. Geographers would have found much interesting material in the general papers dealing with soils, soil conservation, farming and Maori lands of the Gisborne–East Coast districts. For an area barren of geographical literature this essential background knowledge is to be welcomed. The papers will in due course be published in the *Proceedings* of the association.

In the opening paper Mr H. Gibbs of the Soil Bureau accounted for the formation of the skeletal, pumice and alluvial soils of the district by the uplift of the eastern half of the North Island and the repeated volcanic ash showers. Variations in farm management, stock-carrying capacity, fertility and grasses occur between and within these three soil groups. Problems associated with alluvial, pumice and skeletal soils are respectively water supply, animal malnutrition due to lack of trace elements, and accelerated erosion. Mr A. Todd in a paper on soil conservation in the Gisborne–East Coast districts explained that soil erosion in the area was not normal sheet, wind or gully erosion but a greatly exaggerated form of them. Measures necessary for conservation are therefore outside normal farming practices (contour farming, for example) because the land is too steep and the basement rocks too soft. Tree planting and afforestation appear to be the only methods of conservation.

A paper by Mr L. Renouf discussed the change that has taken place on the Gisborne Plain since the 1940's from small-scale market gardening to large-scale production for processing, canning and deep-freezing. The area now produces between ten and twelve percent of New Zealand's food crops, and production per acre of sweet corn, tomatoes and beans has doubled since 1954 on Matawhero soil types. Such increases are likely to continue. The outlook for the other alluvial flats and Tertiary hill country is not so bright. Outlining the farming history of the district, Mr H. Chamberlain, of the Department of Agriculture, explained why this was so. Poor internal and external transport facilities, poorly-distributed seasonal rainfall resulting in winter flood and summer drought, long distances to freezing works and fattening areas, high topdressing costs, rapidity of reversion and erosion, and lack of capital are handicaps to farming on the East Coast. The greatest problem is land ownership and this was discussed more fully in two further papers.

Mr V. Holst of the Maori Affairs Department, outlined the evolution of titles and tenure of Maori land, and Mr C. Goldsmith, in 'Farming Maori Land', said that the reasons for deterioration on the East Coast were multiplicity of owners, insecurity of tenure, inability to pay compensation for improvement, and inadequacies of farming knowledge. He suggested that unworkable land should be taken over by the Crown and that a model farm be established. The problem could be partially alleviated by concentration on smaller and better blocks of land.

In evaluating the economic aspects of aerial topdressing Mr C. Tebb of Hamilton compared and analysed average increases or decreases of wool production and stock units per acre, increases or decreases in gross returns, working expenses, topdressing costs and percentage coverage, over a five year period, for four groups of farms—three on the East Coast and one in South Auckland. Although much hill country can carry grass without fertiliser, it is beneficial to topdress at least fifty percent of the productive area annually.

The field day included a visit to two farms, a topdressing display and an inspection of the soil conservation reserve at Waerenga-o-kuri.

Technical papers contained little of direct geographical interest, but a new field of grassland research was opened up by Dr K. J. Mitchell's 'Results of Microclimate Surveys and their Implications for Seasonal productivity of Pastures'—a field of research already established in New Zealand geographical literature.—R. F. McLean

OTEMATATA: A LATTER-DAY OTAGO BOOM TOWN. While the earliest boom towns in Otago were the result of gold discoveries, the two most recent towns of this nature have been associated with construction camps at hydroelectric-power sites. The building of the dam on the Clutha River at Roxburgh caused the erection of the Roxburgh Hydro township in 1949, but this settlement declined rapidly with the completion of the dam in 1956. The recommendation contained in the report of the Combined Committee on New Zealand Power Supply in 1957 for the construction of an earth dam on the Waitaki River at Benmore* has now led to the rapid growth of a construction town at Otematata.

Since the completion of planning for the Benmore hydroelectric power scheme in 1957 a new town has been constructed three miles below the dam site. Named Otematata, after a nearby creek, this town, situated in a very dry part of the Waitaki Valley, already had a population of 1,700 by August 1959. The population structure has characteristics similar to those of other construction towns: 420 of the 750 employees are single men, the average age of adults is about thirty, and there is a large number of young children in the town. At its peak, Otematata is expected to have a population between 5,000 and 6,000 and a labour force of almost two thousand.

The town itself comprises many of the buildings from the Roxburgh power scheme which were transported 140 miles to form the nucleus of this new construction town. There are 450 family homes and more than 400 huts for single men already occupied or ready for occupation. Despite this camplike appearance, many new buildings contribute to the guise of an established town—a modern block of shops, an impressive theatre, a rapidly-expanding school, an hotel and a maternity hospital. The town has now become an almost completely self-contained unit with a wide range of shops which provide for most commodity requirements and an expanding range of services in the medical, dental, educational, social, sporting and religious spheres.

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*The New Zealand Geographic Board in February 1960 assigned the name Aviemore to this power station.—Editorial Note

In spite of roading improvements, Kurow, eighteen miles down the Waitaki Valley, has become less important as Otematata has become more self-sufficient. Oamaru, sixty miles distant, caters for some shoppers' needs with a free weekly bus service from Otematata.

The construction town has grown rapidly over a period of two years and is now well established. At the present time evidence of rapid progress is most clearly seen on the dam site where the diversion channel is being cut and the coffer dam prepared. The final earth dam, which will be built more cheaply and quickly than the conventional concrete dam, will have a crest length of 2,000 feet, a structural height of 360 feet, and will contain sixteen million cubic yards of filling. This hydroelectric-power project at Benmore, estimated to cost £36 million, will add 480,000 kW to the installed capacity in New Zealand when it is finally completed.—L. J. STENHOUSE

WATERSHED VEGETATION AND THE ANIMAL THREAT. In the minds of most New Zealanders today, 1080 must rival the place held by the long-established 1066. In 1959 the largest petition yet made to parliament was presented; the eighty thousand signatories were in effect asking that the New Zealand Forest Service be restrained from using the poison 1080 in controlling the larger noxious animals, especially deer, which browse the length and breadth of New Zealand, and the control of which is now a Forest Service responsibility.

Naturally enough, the various deerstalkers' associations throughout the country have spared little in their attempts to remove the first real possibility of a major reduction of the millions of their quarry present in the watershed forests and grasslands of the three main islands of New Zealand. The daily press has been flooded with emotional and notably unobjective claims about the damage 1080 has done to birds and domestic animals, and the threat to human life has been a cornerstone in the campaign against the use of 1080 poison. Inevitably the government policy of extermination of all noxious animals has been attacked by some as being undesirable. The fact that noxious animals have caused, and are still causing damage to the vegetation and soils covering upwards of half the area of New Zealand is either ignored, or, if acknowledged, dismissed as of minor importance.

As a result of genuine public uneasiness arising from the Deerstalkers' Association campaign against a Forest Service experiment in poisoning deer in 1958, the Minister of Forests called a meeting in October that year. At this meeting the representatives of organisations and government departments more directly concerned with the noxious-animal problem met together, presented statements and debated the issues—a repetition of the events of thirty years before. Under somewhat similar circumstances in 1930 a conference of interested bodies discussed under ministerial chairmanship the commencement of government-financed deer-control operations. Then as now, the deerstalkers were in active opposition to the government's policy and challenged the scientific observations on which it was based. A. L. Poole dispassionately sums up the 1958 conference: 'The arguments presented on all the problems involved could be reduced to comparatively simple terms; they are all facets of the one problem: what is best for the most efficient land use. It is the jeopardy to the land that ultimately matters: that to forests, to recreation, or to the other things is secondary.'

The full 200-page proceedings of this conference are available on loan from the New Zealand Forest Service, but the *New Zealand Science Review*, Vol. 17, No. 2, April 1959, has devoted a whole issue to four of the most valuable statements dealing with the scientific aspects expounded at the meeting.

A. L. Poole, Assistant Director of the Forest Service, provides a simple introduction on the whole noxious animal problem. The summing up of the Minister of Forests, the Hon. E. T. Tirikatene, made at the close of the conference, reads as admirably as it must have sounded. As the volume of objective research increases, especially of ecological investigations of the sort involved in the current forest and range survey, so does the realisation that 'New Zealand is faced with a problem of control of considerable magnitude that has consistently been underassessed and to which present shooting methods are only a partial answer and, in some areas, no answer at all. Moreover, the problems involved are intricate and difficult and even broad definitions of them are not always clear as yet.'

J. T. Holloway, in a characteristically neatly-reasoned paper, illustrates this latter point of the Minister of Forests in his description of the problems of noxious animals in the South Island alpine watersheds. The logic is hard, the observations profound, the truth all too disturbing. 'There are no areas outside Fiordland for which we can be sure that game-animal production is a permanently safe form of land use. . . . There are only a few small and readily accessible areas where there are any signs that recreational hunting pressure is adequate for maintenance of the forest in good order. . . . Any statement concerning the effects of introduced animals on the vegetation of the alpine watersheds of the South Island that is not explicit as to the precise locality referred to is not to be trusted.' These are a few of the valuable and scholarly points he makes. P. J. McKelvey treats with almost as great skill the North Island protection forests, and again appreciation of regional diversity is a key point. I. J. Pohlen briefly elaborates the frequently-overlooked facts that animals have modified the soils of New Zealand directly, altering it physically and chemically, as well as indirectly by modifying the vegetation.

To anyone prepared to read with an unprejudiced mind, this issue of the *New Zealand Science Review* is disturbing and valuable reading. One could hope that the thousands who signed the 1080 petition might get hold of a copy. But by far the most disturbing thought is that thirty years after the leading ecologist of the day wrote 'for the New Zealand forest they [deer] are a new and increasingly destructive agent', scientists are still trying to prove this observation to a hostile public. Much work must be done before the most efficient land use can be defined. —W. P. PACKARD

THE I.G.U. REGIONAL CONFERENCE IN JAPAN. Since the first congress of the International Geographical Union, held in Antwerp in 1871, there have been only two meetings organised between the four-year congresses. The first of these was held in Uganda in 1955 and the second was the I.G.U. Regional Conference in Japan in 1957.

The report entitled *Proceedings of the I.G.U. Regional Conference in Japan 1957*, published in Tokyo in 1959, provides ample evidence of the value of such a regional meeting. Most of the papers deal with Asian topics and the great majority are on Japanese themes. More than forty papers were contributed from non-Japanese geographers while seventy came from local geographers. Nearly four hundred people participated in the conference and some eighty of them came from twenty countries outside Japan. One will, however, search in vain for a contributor or a participant from either New Zealand or Australia.

It is impossible to comment on the great number of papers, printed in full and with illustrations, that make up more than 500 pages in the *Proceedings*. Suffice to note that the wealth of information in English contained here on Asian geography is indispensable to any student of the area. Moreover as a commentary on geography as a discipline within Japan the report is extremely interesting. Genetic studies in the field of physical geography are very numerous and employ techniques that would repay close attention. The whole range of human geography is also represented, along with some methodological studies, although these last are confined chiefly to the systematic fields. It is not unnatural that the volume concludes with a substantial report of a symposium on the geography of Southeast Asia.

The visit to New Zealand in 1958 of Professor Iizuka of the University of Tokyo was the first step in developing contacts with Japanese geographers. It is indeed a great pity that New Zealand was not represented at a regional conference which was of major importance for this Pacific dominion.—W. B. JOHNSTON

THE INSTITUTE OF AUSTRALIAN GEOGRAPHERS. In August 1958, during the A.N.Z.A.A.S. meeting held at Adelaide, a representative gathering of geographers agreed that the time had come to propose the founding of an academic consortium which would cater better for professional needs than the existing Section P of the association. An interim council was elected and met in Canberra in February 1959, and preparations were made to hold a first general meeting in Melbourne during January 1960. It was also decided to publish under the auspices of the institute a service periodical, the *Australian Geographical Record*, the first number of which appeared late in 1959.

In this issue Professor Griffith Taylor writes a presidential introduction in which he comments on the 'remarkable flowering of the geographical tree' in Australia, and the major part of the journal is devoted to a conspectus of geography in the commonwealth. All university departments are noted, together with the Division of Land Research and Regional Survey of the C.S.I.R.O., and for each the names of personnel and an account of work in progress are given. Finally founder members of the institute are listed, and it is notable that at least one fifth of the academic geographers among these are New Zealanders or are Englishmen who have taught for some time in university institutions in the dominion.

Professional geographers in this country will watch with interest the burgeoning of the Institute of Australian Geographers and will wish it well. Its creation is timely, for Australian geographers have hitherto had little opportunity to focus their activities and their discussions, and perhaps within the near future money will be available for the regular publication of an academic journal which will be a valuable addition to the growing geographical literature of the Southwest Pacific. In any case, the founding of the institute marks a further stage in the advancement of the status of geography in the universities and scientific institutions of the commonwealth. During the past ten years Australian geographers have by their works given proof of their individual worthiness, and the present move towards integration of effort makes for a cohesion that is both noteworthy and indispensable in a country where political divisions and sheer distance are always to be reckoned with.—JAMES W. FOX

THESES IN GEOGRAPHY. As indicated in the last number of the *New Zealand Geographer*, the consolidated list of thesis titles will appear regularly in the April issue and will embrace all theses presented and accepted during the previous twelve months.

Theses accepted for the Ph.D. degree were two in number, and copies have been deposited in the libraries of the University of Auckland and the University of Canterbury:

Climate and Livestock in New Zealand: A Functional Geography, L. Curry;
The Geography of Manufacturing of Auckland, G. J. R. Linge.

The titles of theses accepted for the M.A. and M.Sc. degrees follow, copies of the theses being housed in the libraries of the respective universities:

From the University of Auckland:

The North Shore, Its Character and Functions in 1888, 1913 and 1936, B. J. Griffiths;
A Social Geography of Auckland, D. I. Pool;
The Distribution and Character of the Population of Northland, 1874, 1906 and 1926, C. P. D. Regan.

From the University of Canterbury:

The Lees Valley Intermont, North Canterbury, Its Development and Present Geographic Character, K. L. Bartram;
The Arrow Valley, Western Otago, A. E. L. Britton;
The Wanganui River Catchment—An Essay in Physical Geography, D. W. A. Day;
Land-Use Survey of the Geraldine County Lowlands using Isopleth and Dot Distribution Maps, M. D. Dellow;
Changing Patterns of Settlement in Tauranga County, Evelyn Dinsdale;
The Geographic Character of Residential Christchurch, A. A. Grundy;
Present Climatic Changes in the South Island—A Geographic Analysis, J. A. Johnston;
Factors affecting Flooding in the Wairau Catchment, Marlborough, W. D. Lockhart;

Rural Population and Settlement in Stratford County, Jennie Petrie;
The Changing Landscape of South Canterbury, A. E. Shaw;
The Postwar Growth of Timaru, M. B. Wilkinson.

From the University of Otago:

Milton, A Functional Study of Town and Tributary Region in Southeast Otago, L. J. Stenhouse.

From the Victoria University of Wellington:

A Specialised Agricultural Region—Motueka-Moutere, Waimea County, E. R. Bloomfield (1956);
The Influence of Physical Factors on the Pastoral Production of the Manawatu Lowland, P. F. Coupe (1958);
The Population of Greater Wellington, G. A. Harris;
A Study of Population and Changing Land Use in the Central Areas of Wellington, R. J. W. Neville;
Market Gardening at Otaki, B. G. Pegler.

UNIVERSITY GEOGRAPHY IN BRITAIN. In a letter to the editor, Mr R. Gerard Ward, President of the Maconochie Foundation at University College, London, refers to a statement made by James W. Fox and G. R. Lewthwaite concerning the long university tradition behind geography in Britain. (See 'For Geography: A Review and Commentary', *N.Z. Geographer*, Vol. 15, No. 1, April 1959.) Mr Ward points out that the authors could well have claimed a longer tradition than that beginning with Mackinder at Oxford in 1887. The first Chair of Geography in Britain was established at University College, London, in 1833 when Captain Alexander Maconochie, R.N., K.H., was appointed, being one of four applicants for the position. Professor Maconochie, who at the time was also Secretary of the Royal Geographical Society, held the post until 1836 when he resigned to take a position with Sir John Franklin in Tasmania. On his resignation the post was advertised on several occasions but none of the applicants had sufficient qualifications and no successor was appointed.

Maconochie did not have time to build up a large department but his ability as a speaker was such that his public lectures in the university attracted large audiences, which, on at least one occasion, numbered over 350. Maconochie's major work in geography was carried out through his post as first secretary of the Royal Geographical Society and the editing of the first six volumes of the society's journal was in his hands. During this period he had little opportunity for original writing but his longest work, *A Summary View of the . . . Pacific Ocean*, published in 1818, provides ample evidence of his ability as a geographer.

IN OUR CONTEMPORARIES

1. *In New Zealand Journals . . .*

About the Pacific

THE COOK ISLANDS: R. G. Crocombe, *Post-Primary School Bulletin*, Vol. 12, No. 1, 1958, pp. 36.

VILLAGE LIFE IN FIJI: R. R. Nayacakalou, *ibid.*, Vol. 12, No. 8, 1959, pp. 39. These useful school bulletins demonstrate the value of social studies as an organised integration of knowledge that is particularly meaningful to students up to the level of the middle forms of secondary schools. In considering island groups such as these, this approach is especially valuable since an intimate relationship exists between life and landscape, and both island groups are characterised by ever-changing patterns in the period of Western contact due to the differential impact and acceptance of Western values and technology. Thus viewed from the standpoint of a sympathetic visitor to the Cook Islands, or that of the average Fijian villager, the complex of Pacific island life is more easily comprehended by the young reader than if it were more academically segregated into artificial divisions of history, geography, civics and so on. This is indeed done in part, although less successfully than sections which progressively widen in their perspective from the village level to that of the province or island, and finally to the level of the group as a whole.

R. G. Crocombe describes the daily round of work in a village on the island of Atiu before dealing with the main facts about the Cook Group as a whole. Housing, diet, fishing, government, education, religion, celebrations and sports are dealt with admirably, although agriculture is skimped a little and the major environmental characteristics of basaltic 'high' islands or coral 'low' islands are barely mentioned at all. The intractable problems of interisland transport in a group scattered over 850,000 square miles of unpredictable ocean are emphasised, together with their effects on the trade in perishable fruit for the New Zealand market. One regrets the absence of a map of Rarotonga and a cross-section or transect diagram of a 'raised almost-atoll' showing contrasting types of land use on makatea, swamp and basalt.

R. R. Nayacakalou lucidly introduces two of the greatest lessons of anthropology: 'how and why different peoples live differently' and 'how and why problems arise when people from different countries meet'. On some questions, however, the author wisely leaves the interpretation of 'why' to stimulate the thoughtful reader. The bulletin gives the main facts of physical geography, history, government, industries, villages, housing, clothing, food and drink, agriculture, hunting, fishing, entertainment, religion, education, and earning money in the village. The main principles of social structure, so important in a society still organised by the warp and weft of kinship and motivated by traditional concepts of status, are plainly described in a form that can be readily understood by young readers.

In his conclusion the author introduces the problem of urban drift, regretting the consequent devitalisation of clan groups and village life as a whole. While this is a serious problem, recent research has indicated the inadequacy of many villages as economic units today when increased cash cropping is urgently needed in view of the increasing numerical and economic dominance of the Indians. A brief mention of exempted Fijians living independently outside village communities would have been useful, as their increasing numbers and promising production figures indicate one alternative and profitable line of economic advance. One deeply sympathises with the author's rather forlorn expression of hope that conditions will change so that village life will not appear so dismal to so many—a hope for the satisfying things of village life, 'its simplicity, its security and peace, its shared work, and the excitement and laughter of living as a group'. But the unpleasant truth is that the trends of social change—of which urbanisation and individualisation are important manifestations—are inexorable and inevitable. As Professor Spate has said in his report on the Fijian people, Fijians 'cannot contract out of the twentieth century'; nor indeed can they contract out of a situation of increasing Indian numerical and economic dominance. It is to be hoped that this fine bulletin on the Fijian half of Fiji will be followed by another on the Indian half.—R. F. WATTERS

2. *In Oversea Journals . . .*

NEW ZEALAND'S ASTONISHING PROGRESS

NEW ZEALAND AFTER TWENTY YEARS: A GEOGRAPHER'S VIEW: K. B. Cumberland, *Geographical Journal*, Vol. 125, Pt. 1, March 1959, pp. 38-47.

This is an exceptionally informative account of New Zealand's economic progress, with a glance at international status, in the last twenty years—roughly, since the passing of the depression in the 'thirties. It is of special interest in that Professor Cumberland came new to New Zealand at the beginning of this period. He says he had no knowledge of this country. Those with longer experience—my own goes back sixty years or more—will naturally compare their impressions of change with his. To them the country's progress may seem more wonderful still. By 1940, for example, the centennial year, a really bad road, which might maroon a settler in winter, was becoming exceptional and even rare. In my boyhood the great development of dairying was hardly dreamt of; North Auckland depended on kauri gum and timber, the regeneration of the Maori was just beginning, and there was trepidation in parliament at the innovation of a vote for agricultural research. We were still in the age of the 'practical man'.

We have changed all that, or most of it, and Professor Cumberland does justice to the great strides made by primary, processing and other industries. He has put into readable form a great mass of information, which, with certain reservations, constitutes a first-class advertisement, in small attractive compass, of national progress —an exposition that should impress people overseas and be a revelation even to some New Zealanders.

The first reservation is concerned with the opening summary of changes wrought by English colonisation. In 1840, Professor Cumberland says, this was 'a predominantly forested land', whereas 'by 1938 the forest had been all but completely removed'. When all allowance is made for the destruction of our forests, so thoughtless at times, this is surely a misleading generalisation. There are still large areas of forest, much of it protected. In a recent year 300 million board feet of timber were cut from native trees. The second criticism is more serious. Professor Cumberland says that at the beginning of this period New Zealand's 'international outlook and its national sentiments were crystallised in its unquestioned acceptance and blind following of British policies so concisely summed up in M. J. Savage's phrase uttered almost before Chamberlain had ended his broadcast declaring war on Germany: "Where Britain stands, New Zealand stands; where Britain goes, New Zealand goes".' Mr Savage certainly so aligned his country, but a spirit of independence had developed between the wars, and before 1939 Mr Savage's government had taken the historic step of differing with Britain in the League of Nations—the first breach of its kind. In *New Zealand and the World* Professor Wood describes this departure from policy as a dramatic rebellion.

Some New Zealanders may think the picture Professor Cumberland draws of their country as he first saw it rather harsh, not so much perhaps in its panorama—'a blatantly pioneer colonial land, incompletely transformed, inadequately tamed, still sparsely occupied, raw, fresh and new, but youthfully exciting and inviting'—as in details of that rawness, such as the ugliness of towns and neglect on farms. We must remember, however, that he came from one of the neatest, tidiest and most carefully tended of rural countrysides, England. Has Professor Cumberland discovered that in that chequer-pattern of landscape there is something that irks the New Zealander; that the exile has been known to say he longs for a bit of untidiness? Our Waikato Cambridge, so umbrageous and green-meadowed, has been voted 'tame'.

However, Professor Cumberland is highly informative, and eloquent, about our progress. Land has been used so much more efficiently that production has risen by more than forty percent in eighteen years, and, at the same time, the volume from manufacturing industries has jumped, and, in value, soared. Industries developed from timber resources 'constitute the most notable single addition to the New Zealand economy in the last twenty years'. The most striking feature of the national advance is the application of science and new ideas generally to the land. We have become famous for our grasslands, which are said to be the best in the world. Even by 1935 the volume of agricultural production per capita of persons employed was higher than anywhere else. Five years later, Oliver Duff said in his centennial book, *New Zealand Now*, that we had 'come to the end of blind living', and indeed we had. Land thought to be worth little has been made productive. Professor Cumberland gives special praise to the work of Sir Bruce Levy and Dr Peter Sears at the Grasslands Division of the Department of Scientific and Industrial Research. Annual butterfat production per cow has gone up thirty-five pounds in twenty years, and fleece weights have been pushed up twenty percent.

In 1959 a well-known special correspondent of the *New York Times* after a four-day visit to New Zealand, commented on our 'Static Utopia'. We were prosperous and happy, but our society was overprotected and appeared 'myopic with respect to the problems already looming before our generation'. Less well endowed nations sought to 'shift from a reliance on primary products and agriculture to manufactures and capital goods'. By contrast Australia was rushing forward, was becoming 'a modern mass-production state'. Many will agree that we are overprotected, but it might enlighten Mr Sulzberger to read this address by Professor Cumberland. Among questions he could be asked is this: 'Is there less merit in growing two blades of grass where one grew before than in sending two motor vehicles down an assembly line in place of one?' The general state of the world's population would seem to show that there is not. If a flitting critic is looking for mechanisation in New Zealand he will find plenty of data in this survey. In 1957, on our 90,000 farms, there were 39,000 milking-machine plants, 22,000 shearing plants, 85,000 tractors, and many thousands of other machines. We have one motor vehicle to every three persons, a ratio as high as that of Canada and the United States. Aircraft spread almost 500,000 tons of fertilisers on pastures, and are also used for sowing and spraying.

Among social conditions noted by Professor Cumberland are the high standards of living, the demand for and cost of housing, the movement of people from country to towns, and the increase in Maori population. In my childhood many thought the Maori was doomed, but his numbers are increasing more than twice as fast as those of the Europeans. In 1938 one in every twenty New Zealanders was a Maori; twenty years later he was one in fifteen.

Of course Professor Cumberland mentions new problems, such as those that come 'in the trail of increased urbanisation', including results of 'the cult of the quarter acre', and the need for overhaul of local government. But his final comment is that 'on the national and international scale New Zealand has matured rapidly in twenty years'. It is good to read that in this he includes 'non-material aspects of national life'. New Zealand 'is slowly evolving a New World, but Pacific, culture distinctly its own'. There is a disposition to regard a land like this as uncultivated in things of the mind—as 'only a lot of farmers'. Really we have a high standard of literacy, using the term to mean more than just the three 'R's', brains have long been an important export, and of recent years there has been a marked advance in native literature and in the arts generally.—Alan Mulgan

People and Problems in the Pacific

THE POPULATION OF FIJI: R. Gerard Ward, *Geographical Review*, Vol. 49, No. 3, July 1959, pp. 321-41.

This study appears at a particularly appropriate time. The Burns Commission has recently conducted an investigation into Fiji's natural resources and population trends, with a view to recommending 'how the development of the Colony and its resources should proceed'. In a small island group with a narrow resource base, a large percentage of steep hill country, and with declining or fluctuating production of copra and bananas, the increase of Fiji's population by one third between 1946 and 1956 is a matter of grave concern. These disquieting facts have been largely concealed in this period by the fortuitous rise in export prices for agricultural produce, and by the steady expansion since 1950 of sugar production, so that today, on the eve of quota-cutting because of overproduction, there are signs of uneasy dependence on this one crop. Fiji's problem is basically one of a widening gap between population growth and agricultural production. The situation is further bedevilled by the impact of population growth on the internal balance of power between the two main ethnic groups, the Fijians and Indians.

Mr Ward quite properly does not concern himself with these wider issues, which can only be resolved, if at all, after systematic study of the nature of individual elements in the whole complex problem. For his part, he tackles population, the most variable element, in a very thorough and objective fashion. Population increase and changing racial composition are described from 1881, and population distribution in 1956 is clearly mapped. The distribution patterns are analysed in terms of the economic activities peculiar to each group. A convincing analysis of internal migration is illustrated by excellent maps of Fijian and Indian population changes between 1946 and 1956. Increases and decreases of population in Fijian villages are mapped and the changes are attributed to the attraction of employment opportunities in towns or to the diminution of the size of the village labour force to a point which induces the migration of the remnant to join up with another village.

The author makes useful comments on changing growth rates by comparing death rates, sex ratios and youthfulness of the Indians and Fijians at different periods. In view of the shortage of unmarried Indian females and the low death rate, Mr Ward feels that the Indian rate of increase will not fall much below the present average annual figure of 3.46 percent in comparison with the Fijian figure of 2.29. These are such significant facts that this reviewer would have liked fuller examination of the likely pattern of growth, such as consideration of net reproductive rates, and fuller interpretation of the age-pyramid patterns.

Mr Ward's study forms an excellent basis for further research by social scientists. A study of population pressure in its various aspects is a logical next step, while studies of land tenure and related land use and urbanisation are also needed to determine the impact of population growth and its effect on the integration of racial groups. Sir Henry Clay's suggestion in 1954 for an ecological survey of the empty mountainous interior of Viti Levu should be followed up in view of the pressing need for new avenues of economic development.—R. F. WATTERS

REVIEWS

A Hundred Years After

GEOLOGY OF NEW ZEALAND. By Ferdinand von Hochstetter, translated by C. A. Fleming. Wellington: Government Printer, 1959, pp. 320, 60s.

Hochstetter's place in New Zealand geology rests not merely on the fact that his was the first comprehensive work descriptive of the geology of these islands, but also on the very real merit of the observations and interpretations that he made. His work was characterised by meticulous attention to detail coupled with a flair for rapid appreciation of broad perspectives. He was thus able to visualise relationships on the grand scale without being distracted by the many minor features that held his attention. His interests were manifestly catholic and fastened on the geological *minutiae* of all types that he encountered in his explorations as avidly as on the major problems. He described and speculated about them all with an infectious enthusiasm, so that in his books he is revealed as a vital man fascinated in a joyous work rather than one engaged in an arduous task. Yet arduous it must have been, for the detailed mapping of very large areas in a virgin region which he accomplished within the compass of a few short months must have demanded great industry as well as outstanding ability. In his translation of Hochstetter's great work Dr Fleming has managed admirably to preserve that intimate and personal, yet authoritative, tang of Hochstetter's original writing which conveys so clearly this impression of dynamic power.

The broad pictures of general relationship of rock formations which Hochstetter established laid the foundation for the solid regional mapping of New Zealand. This was the major outcome of his work but is now largely of historical importance and as such would hardly have justified the labour of translation or the cost of publication, for its appeal would have been limited. It is his detailed observations that remain—and always will remain—of lasting interest to a very wide field of readers.

Dr Fleming's translation is most welcome for several reasons. First, it is a worthy tribute by one of our leading modern geologists to the first great geologist in this area—and moreover it is most fittingly published in this the centenary year of his visit to the country. Second, it makes available to all workers in geology and geography, at a reasonable price, a rare book of great historical importance. And, for those who have little or no German it provides ready access to an authority that must still be consulted frequently. It is more than a record of an early geologist's visit. Some of its sections—as, for example, that on the 'Volcanoes of Auckland'—have not yet been adequately replaced by modern work, and in this particular case much that Hochstetter could see is now obscured by city development. Although many of his interpretations and speculations have been superseded in the light of subsequent investigation, the detail of his observations (as in the Rotorua-Taupo district), preserved both in word and illustration, is of very great value to the present-day worker.

Editorial footnotes, by the translator, on the geology of the localities described by Hochstetter, and on personalities and places mentioned in his account, make the book more intelligible to the reader of today. Whilst trying 'to give as liberal a translation as is consistent with easy reading' Dr Fleming has succeeded in preserving 'the spirit and literary style of the century and the tongue in which Hochstetter wrote'. This has led to some rather stilted and cumbersome diction, but it has the virtue, however, of making the modern reader feel that it remains Hochstetter's book and retains his, rather than Fleming's, personality.

Of course, the Government Printer has been unable to match the gracious luxury of the original publication, with its fine binding and elegant format. To have attempted to do so would have been largely to defeat the main purpose of the book—its cost these days would have been so prohibitive as to make the translation as unavailable to the readers for whom it is intended as is the original work. Inevitably in reproduction some of the charm of the lithographs and of the engravings has been lost. The half-tone plates, reduced in size, preserve the detail but give little idea of the delightful two-colour original lithographs. But nostalgia must not be permitted to cloud realistic judgement—the publisher has done his work well. The maps (Plates 1 to 6) have been reproduced by photo-offset from those, with lettering and legends in English, which were reprinted in 1864–1865 for publication in the Geological and Topographical Atlas, by Delattre of Auckland. Whilst they have lost, to some extent, the colour, clarity and vitality of the originals they will be most satisfying to those unfamiliar with the atlas. The very detailed index of thirty pages compiled by the editor is a most useful addition.

This book will be welcomed by geographers and geologists alike, as well as by those who have an interest in early New Zealand. Dr Fleming and the Government Printer are to be congratulated on the production of a work of such value. It has obviously been a labour of love.—E. J. SEARLE

A GIANT AMONGST MEN

GUTHRIE-SMITH OF TUTIRA. By A. E. Woodhouse. Christchurch: Whitcombe and Tombs, 1959, pp. 302, 27s. 6d.

To those many people who regard *Tutira* and *Sorrows and Joys of a New Zealand Naturalist* not only as valuable and accurate accounts of important phases of the country's history and natural history but also as amongst the best-written of all books on New Zealand, Mrs Woodhouse's sympathetic biography of Guthrie-Smith, pioneer and pastoralist, naturalist, ornithologist and ecologist is something of a disappointment.

It is a full-scale and painstaking account of the life and work and interests of Herbert Guthrie-Smith. It chronicles his Scottish background, his arrival in New Zealand, his adventures at Tutira, his immense and persistent curiosity, his explorations of nature in different parts of his adopted land, his expeditions to the subantarctic islands, his visits 'Home', his literary labours, his scientific status and achievement. It relies heavily on, and quotes generously from, Guthrie-Smith's correspondence with friends and associates in many walks of life.

But somehow, despite all this, it reveals less of the man than do his own works. *Tutira* itself tells more of his enthusiasms, his philosophy, his humour and humanity, and shows its readers 'a person of strength, nobility and fine feeling'. It would be incorrect to say that this biography was unnecessary. It is a valuable document and will fill many biographical gaps for present and future generations of Guthrie-Smith's readers. But the biographer of an author such as Guthrie-Smith faces a most difficult task.—K. B. CUMBERLAND

PROBLEMS AND POTENTIAL OF WESTLAND

WEST COAST REGION. National Resources Survey, Part 1. Compiled by the Town and Country Planning Branch, Ministry of Works. Wellington: Government Printer, 1959, pp. 180, 35s.

The regional literature on the west coast of the South Island has been substantially increased by the publication of at least five books in 1959. This sudden proliferation of studies on one of the most distinctive areas of New Zealand is to be attributed in part to the growing awareness of the region's 'problem' status and in part to the decision to celebrate the centennial of Westland in 1960. After almost a century of recurrent fluctuations in population, Westland today is an area of arrested development and population stagnation. Although the total loss of population has been slight and there is no unemployment as yet, the high rate of natural increase of the population implies a substantial outwards migration, especially of the young working-age group. These trends, together with the marketing problems faced by the coal industry and the virtual extinction of gold mining, have aroused concern for the future and led in 1959 to the appointment by the government of a West Coast Committee of Inquiry.

The committee's deliberations have undoubtedly been aided by the publication of *West Coast Region*. Geographers will welcome this book, not only for the information it contains on the West Coast, but also as the first in a series of national resources surveys designed to provide background data for government departments and local planning authorities. The research team consisted largely of graduates in geography, but one suspects that the work was compiled in Wellington with a minimum of field study. The geological chapter was written by two field geologists, G. C. Shaw and R. P. Suggate, and the chapters on soils, agriculture and forestry incorporate the published work of other first-hand observers, but wider field study by the Ministry of Works team would have given a sharper perception of the region's problems and might have obviated some inaccuracies of fact. It is to be hoped that this shortcoming will be remedied in future volumes in the series.

The book is not a planning survey and does not offer solutions to the region's problems. It is an analysis of present conditions interpreted in the light of trends in the recent past. The survey takes the widest possible definition of the West Coast and includes Murchison county as well as the indisputably West Coast counties of Buller, Inangahua, Grey and Westland. The book describes not only resources but also economic activities, and indeed the volume could perhaps be classified more accurately as an economic geography rather than a resource inventory.

There is an introductory 'Background' and a concluding 'Prospect'. Ten chapters deal in systematic fashion with geology, soils, climate, population, agriculture, coal mining, forestry, employment, transport and the tourist industry. The most useful new material for the geographer is the analysis of population and employment, while the most interesting map is probably that showing population trends between 1926 and 1956. It is a great pity that the forestry section quotes a very inaccurate provisional estimate of the timber resources made by the Forest Service in 1953 (p. 119). The final report of the National Forest Survey was published in 1957 and the corrected figures should have been incorporated in a book published two years later.

There are fifty-five statistical tables, thirty-one maps and graphs in the text, and seven large folded maps inside the back cover. All are reproduced on an ample, indeed lavish scale. More than ninety half-tone photographs of generous size convey a feeling for landscape and 'atmosphere' lacking in the rather severe prose of the text, but they undoubtedly added to the cost of the book. Many views have only a remote connection with 'resources' and one might question the use of forty-eight square inches of page 127 to show three lorries unloading coal.

The text and maps contain a number of lapses. On page one the explorers Charles Heaphy and Thomas Brunner are economised into a mythical character called 'Charles Brunner'. The administrative history on pages 5 and 6 has gone a little awry. The Nelson part of the West Coast was not involved in the County of Westland Bill, 1867, as implied here. Not all would agree with the contention of page 77 that a mature agriculture can be attained 'only when beef cattle and sheep production are carried on as secondary lines in association with dairy production'. There is nothing immature about using pastures for the intensive production of meat. The map of 'land farmed with some degree of success' (*Fig.* 25), is rather inaccurate for South Westland and could have been remedied by a few hours' study of available air photographs. On the other hand, the Arahura Valley, oldest agricultural district and a showplace of West Coast farming, does not appear on the map. The map of railways in 1894 (*Fig.* 105) shows non-existent lines to Roa and Rewanui, but omits the Westport to Cape Foulwind line. The endpaper map of coal production wrongly designates the Garvey Creek mines at Reefton as producing sub-bituminous coal. The map also contains a cartographic lapse in that sub-bituminous coal, although of intermediate rank between bituminous and lignite coal, is shown in the heaviest shading, bituminous in the lightest and lignite in an intermediate shade. Generations of university classes in elementary cartography are likely to have this held up as an example of what to avoid.

On a more general plane, one misses an overall assessment of the relative importance of the different resources and economic activities in the economy of the West Coast. A table, based either on value of output or on employment, should not have been beyond the capacity of the research team, but nowhere is there reference to farm employment although the Department of Statistics made such a return in 1950. Another gap is the absence of large-scale maps of present land use and of the physical properties relevant to land use. Many decisions affecting regional and local development would be sounder if such maps were available. Perhaps future resources surveys could include land use and land capability mapping in their programmes. Perhaps also, the names of the members of the research teams could be published, as is standard practice in the investigational work of many other government departments.

However, these criticisms made, the book remains a promising start to the series and the standard of production reflects great credit on the Government Printer.

—Murray McCaskill

Maori History of the Taupo Country

TUWHARETOA: THE HISTORY OF THE MAORI PEOPLE OF THE TAUPO DISTRICT. By John Te H. Grace. Wellington: A. H. and A. W. Reed, 1959, pp. 567, 42s.

The publication of *Tuwharetoa* marks a notable addition to the literature of the Taupo district. Few areas and few, if any, of the major Maori tribes have their history and traditions recorded so fully and so ably as Mr Grace has now done for Ngati Tuwharetoa.

The first two of the three sections of the book deal with the story up to the 1840's and are based mainly on tribal traditions. The gathering of the various versions of the traditions as related by the many subtribes, and the organisation of these into a coherent story, has been a difficult and lengthy task. The third section, dealing with the past hundred years, is greatly enriched by the use of material from the papers of Mr Grace's own family. Much of this material has not been published hitherto. However, if Mr Grace's family connections give him unusual advantages for setting down the more recent events, so too do they fit him for relating the tribal traditions. As the son of the last of the *ariki tapairu* (the senior female *ariki* line) of Ngati Tuwharetoa, he is able to speak with all the authority of a high-ranking member of the tribe whose story he tells.

The history of the ancestors of Ngati Tuwharetoa is traced back to the time of Ngatoroirangi, the high priest of Te Arawa canoe. On arrival in New Zealand the people from whom Ngati Tuwharetoa are descended settled near Maketu, Bay of Plenty, and intermarried with the tribes already living there. In the sixteenth century, Tuwharetoa, the eponymous ancestor of the tribe, dwelt near Kawerau, a representative of the new aristocracy which had combined the chiefly status of the fourteenth-century arrivals with the rights to land of the earlier inhabitants.

As a result of local pressures the sons of Tuwharetoa moved inland, and after conquering the Ngati Hotu—the largest tribe then living in the Taupo district—they established the *mana* of Ngati Tuwharetoa throughout the Taupo country. By alliances and warfare Ngati Tuwharetoa established links with certain of the people of Hawkes Bay and, later, the Waikato. When some of the latter moved to the Manawatu the relationships were further widened.

Throughout the eighteenth and early nineteenth century, Ngati Tuwharetoa were often engaged in warfare with neighbouring peoples. As they occupied the central part of the North Island this seems to have been almost inevitable, for any major disturbances in coastal areas tended to affect the interior. Eventually Christianity brought peace in the middle of last century. However, as a result of the great *mana* of its chiefs and the fact that Ngati Tuwharetoa were closely connected with the Waikato people, they became involved in the events leading to the King Movement and the Waikato War. Under Te Heuheu Horonuku the tribe fought in the Waikato War, and later allied briefly with Te Kooti. But Te Heuheu Horonuku soon made peace, and later it was through him that the Tongariro National Park was presented to the state. Since then Ngati Tuwharetoa have followed a more peaceful path.

The story is complicated, for Ngati Tuwharetoa roamed widely over the North Island in the past six centuries. The fitting together of the fragments of traditional history has thus been difficult, and parts of the story seem rather disconnected and the sequence of events is at times difficult to follow. The provision of more location maps would have assisted the reader to follow the various migrations and expeditions and to find the numerous place names which are no longer in common use but which take on new meaning and interest now that their origins are explained.

But these are small points beside the whole work. Mr Grace has succeeded admirably in the difficult task of presenting such a mass of material in an extremely readable form. The book represents a notable piece of scholarship extending over nearly twenty years, and as the result of this Ngati Tuwharetoa can boast a detailed and lively history almost unequalled by that of any other tribe.—R. Gerard Ward

Maori Topography of the Wellington District

THE GREAT HARBOUR OF TARA: TRADITIONAL MAORI PLACE-NAMES AND SITES OF WELLINGTON HARBOUR AND ENVIRONS. By G. Leslie Adkin. Christchurch: Whitcombe and Tombs, Ltd., 1959, pp. 145, 28s. 6d.

Geography as a discipline has undergone many changes of emphasis, and even in this age of increasing diversification of interests there is time to pause and catch up on 'place' geography. In his revision of Maori place-names and sites of Wellington, G. Leslie Adkin has, by implication, set out to do justice to the Maori, who was, according to the foreword, a geographer *par excellence*. Another purpose of the author was to set out the existing knowledge in a 'systematic and easily accessible form'.

Neither of these two aims has been quite realised from a geographer's point of view. The form of alphabetical listing of place-names results in valuable data being hidden under individual headings. An appreciation of the Maori as a geographer can only emerge when all this hidden material, and other data as well, has been presented in another form. To satisfy the requirements of modern readers of the subject in terms that they can appreciate requires a broader, less fragmented sweep over the landscape. Such topics as settlement patterns, population movements and land utilisation need to be stressed before a regional study can be said to be anywhere near completion. All this is the work of the field archaeologist who must locate, identify and interpret sites in the field and in archives when they have ceased to exist as components of the landscape.

In this respect, G. Leslie Adkin has made an impressive and necessary prelude to any regional study. The work of many years has gone into compiling this revision which must long remain as the standard reference for local Maori place-names. Mr Adkin's love of Wellington and of Maori tradition combine to create a valuable book on nomenclature which reflects his enthusiasm, patience and skill as a research worker. The writing is concise, the maps are profuse in detail, and the photographs are adequate. An interesting and valuable addition to the text is the high-level aerial oblique with site numbers superimposed on it.

Mr Adkin's first love, geology, makes its appearance on pages 18 and 19 with another marriage of Maori tradition to a sterner partner. Two illustrations of the evolution of Miramar Peninsula by the process of island-tying are put forward in support of the traditional Hao-whenua earthquake and uplift of A.D. 1460. The 'complete geological evidence' (p. 17) should at least be given a footnote reference for the reader is left to interpret the two illustrations as best he can. Indeed, the successive gravel bars and sandspits in Figure 2 may suggest to the non-specialist a series of small uplifts, or perhaps gradual uplifting, rather than a single sudden elevation.

On minor points Mr Adkin could be challenged. In Map VII he has placed Te Tatau-o-te-po meeting house on the Western Hutt Road instead of the Hutt Road: on the Owhariu Bay headland (Map VI) he has shown three *pa* where one only exists (although there are two terrace formations nearby which may be village sites and not *pa*); his interpretations of Maori place-names, particularly Motu-Kairangi, are open to question as they appear to be based not on an intimate knowledge of Maori but on Williams's *Dictionary of the Maori Language*.

In spite of these criticisms Mr Adkin has compiled a book of merit. Fieldworkers in Wellington have recognised his contribution to local studies, and his latest book should arouse many Wellingtonians to a deeper interest in the Great Harbour of Tara.—J. B. PALMER

NORTHERN AND CENTRAL OTAGO

NORTHERN APPROACHES. By C. W. S. Moore. Dunedin: Whitcombe and Tombs Ltd., 1958, pp. 250, 25s.

EARLY DAYS IN CENTRAL OTAGO. By Robert Gilkison. Christchurch: Whitcombe and Tombs, Ltd., 1958 (Third Edition), pp. 191, 16s. 6d.

The publication of *Northern Approaches* completes the series of fifteen district histories, produced by the Otago Centennial Historical Committee, which cover the origins and growth of local settlement in Otago. In addition, two other volumes, *The Otago of Our Mothers* by Eileen L. Soper, and *The Face of Otago* by B. J. Garnier, were published, as well as the parent work, *The History of Otago* by A. H. McLintock.

The division of the province into a number of distinctive areas or 'regions' was based on geographical or social factors. The result has been that these local community areas have been studied as microcosms, the hope being that 'they would reveal intimately the pattern of social adjustment to a new and changing environment'. The division has been generally satisfactory, although in some cases more attention has been given to the regional centre and much less to the peripheries of these areas of community interest.

Northern Approaches is a history of Waitati, Waikouaiti, Palmerston, Dunback, Moeraki, Hampden and surrounding districts. After an examination of the regional setting against which the drama of history has been played, the early settlement of the area is described. Chapters deal with the communications, industry and agriculture, and show the importance of these activities in the early days and the gradual decline of the area with the improvements in transport and with the reduced need for self-sufficiency. But it is suggested that agricultural development 'is now on the threshold of new life which could revitalise the towns and attract new settlers'. Another two chapters deal with the 'Northern Towns', in which are situated the county offices and most of the population, and the 'Southern Resorts' where townships composed mainly of summer cottages have grown haphazardly. Other chapters cover the social, educational and religious developments of the area.

This volume, unlike some in the series, contains a map, bibliography and index which give to it an essential element of completeness. Again an excellent selection of historical photographs adds much in descriptive value to the facts contained in the text.

The appearance of a third edition of *Early Days in Central Otago*, which has been out of print for many years, makes available to the geographer as well as the historian information on the early settlement and development of this interesting area. It is in the field of historical geography that the book is of most value, for although much of the material is a narration of tales and events of the early days the uniqueness of this geographical region is realised and to some extent described. 'Consisting largely of tussocky plains, watered by immense rivers, and surrounded by lofty mountains, Central Otago is ideal country for either the sheep farmer or the gold miner.' The early settlers came in search of either the golden fleece or alluvial gold, and their arrival and subsequent activity in the Tuapeka, Dunstan, Arrow and Shotover areas is fully described, while chapters are also devoted to such notable characters as Bully Hayes and Garrett, and 'Bushrangers and Robbers', 'Chinamen' and 'Typical Pioneers'.

Much of the material considered useful by the historical geographer appears as incidental to the main theme of the book, but some chapters such as 'The Golden Fleece', 'Coaches and Roads', 'The Great Molyneux Flood of 1878' and 'The Era of Gold Dredging' are of direct geographical interest.

The selection of photographs appearing in this edition is noteworthy both for the present-day views of the region and for the historical views which have been derived mainly from the files of the *Evening Star* and the Turnbull Library. It is, however, unfortunate that many of the historical photographs including 'Cromwell in the Sixties' and 'Clyde in 1869', which appeared in earlier editions, have been omitted.

For this third edition some minor errors in the text have been corrected. The map which appeared in an earlier edition is unfortunately not included in this new edition and without it much of the true perspective of the interesting story which is told will be lost to many readers.—L. J. STENHOUSE

GUIDES TO SOUTH ISLAND NATIONAL PARKS

HANDBOOK TO THE ARTHUR'S PASS NATIONAL PARK. Christchurch: Arthur's Pass National Park Board, 1958, pp. 84, 6s.

MOUNT COOK NATIONAL PARK HANDBOOK. Edited by W. P. Packard. Christchurch: Mount Cook National Park Board, 1959, pp. 84, 4s.

These two modest volumes are in a real sense natural history handbooks of an unusually high order. They should appeal to a variety of readers, from the day visitor to one familiar with every stone on the road; from the oversea tourist, curious about his surroundings, to the native-born turning his thoughts towards his mountains of high endeavour. Here are brief, readable accounts of plants, birds, topography, history and geology, written by experts for the ordinary man, and conveying the charm as well as the facts of a specialist's subject—no mean achievement. The more prosaic aspects—tracks, huts and ski-ing conditions—are competently dealt with, thus making these small, compact booklets adequate for rucksack, hut or cottage, though the high climber will need, for information on routes, to supplement with the classical alpine literature and detailed maps. For ordinary purposes the maps in these handbooks are clear, up-to-date, and within their scale, accurate, though this reviewer was devoutely thankful to find one hut nearer and lower than the map had indicated.

Inevitably, when many have shared the labour, something of unity and individuality is lost; and when the canvas is larger the loss seems greater. In the Mount Cook handbook one misses a little of the splendour of the scene, though admittedly this is conveyed magnificently in the photographs. With such a wealth of photographic material available, the choice in both volumes shows fine discrimination. Here is variety of subject, splendid execution, and great artistic merit. Miss Adams's drawings, more particularly those of plants and flowers, are the final delight, conveying a touch of poetry to these pleasing handbooks.—Eileen Fairbairn

A World Survey

WORLD GEOGRAPHY. Edited by Otis W. Freeman and John W. Morris. New York: McGraw-Hill Book Company, Inc., 1958, pp. 623, $7.95.

Introductory American college textbooks in geography and the courses for which they are written have shown a marked trend toward the world survey approach in recent years. This development is part of a larger trend to require every student to take a core of 'general education' courses regardless of the major field of his degree. While it has brought a wider acceptance of geography in the universities, it has resulted in an elementary, descriptive approach to the subject. Yet it must be remembered that the American high-school graduate comes to the university with little or no background in geography and that, therefore, an introductory college text must attempt to remedy a great many deficiencies. The editors of *World Geography* undoubtedly found themselves swept along in the educational current of the times. In their preface they state that the text can serve as a survey in the general education curriculum, 'especially where such a course is the only one the student will take', but it can also be used as a text for 'a second course following that on principles of geography'. One can easily draw false conclusions about the aims of general education!

World Geography has sixteen authors, including the two editors. Thus it brings together the contributions of regional specialists and provides a better balance than is likely from a single author. Multiple authorship of an introductory text imposes a heavy burden on editors, however, and it is easy to lose sight of a basic plan of organisation. For example, it is not immediately apparent whether the 'Arctic' climate of Canada (p. 117) or of Alaska's north coast (p. 144) is the same as the 'tundra' climate of the world outline on page 7. On page 232 Finland and northern

Sweden have a 'humid continental' climate, but on page 356 adjacent U.S.S.R. has a 'subpolar continental' climate.

In assessing the content of a text of this sort it is logical to examine the material on familiar areas. In the section on New Zealand is the statement that 'the population of New Zealand is slightly less than two million', and that although the Maoris are 'reduced in numbers—perhaps fifty-six thousand survive'. The *New Zealand Official Year Book, 1958*, states that the population reached two million in 1952. The *increasing* Maori population reached 56,987 in 1921, and more than doubled to 137,341 in 1956.

An outstanding feature of the book is the brief atlas of excellent coloured maps in the introduction. These maps will most certainly facilitate ready reference, but one hopes they will not lead students to forego the benefits offered by a more adequate atlas. Black and white maps in the text are generally of high cartographic standard. Some of the spellings of place names are inconsistent with those in the atlas: Fremantle and Freemantle, Lake Baikal and Lake Baykal, Sharjah and Shardjah, Bandung and Bandoeng. There is a great deal of confusion about Chinese place names in text and maps, especially among Wu-Han, Wu-han, Wuchang and Hankow. Photographs are numerous and well reproduced; many are excellent supplements to the text. Chapters are organised strictly on the basis of regions and subregions, with introductions and summaries for each major division. There are questions and references at the ends of chapters and a glossary at the end of the book.—HOWARD J. CRITCHFIELD

URBAN COLOSSI AND THEIR PROBLEMS

THE CONURBATIONS OF GREAT BRITAIN. By T. W. Freeman. Manchester: Manchester University Press, 1959, pp. 393, 37s. 6d.

For geographers studying Great Britain there has always been a surprising inadequacy of information on the contemporary British scene. It was with a sense of anticipation, therefore, that the writer welcomed the opportunity to review this book. Initial reaction was one of disappointment. In part this stemmed from the nature of the source materials on which the study relied, but to a far greater extent it derived from the manner in which the professed though possibly misleading aim of the book, 'to shed some light on the distribution of the town population in the nineteen-fifties', was essayed. This objective is attempted by the prevalent British technique whereby the understanding of the present is considered through a study of historical development. Partly as a consequence the book is unsatisfactorily balanced, disproportionate space being devoted to purely historical considerations and relationship of administrative units.

In this sense, therefore, the book cannot be regarded as an adequate source on the contemporary geography of the conurbations of Great Britain. On the other hand it brings to the notice of the geographer, aspects of urban geography frequently overlooked or relegated to minor roles. The reader is left in no doubt of the extent to which irrational administrative fragmentation has created insoluble problems. With depressing frequency there emerges the importance of the patterns of local jealousies and animosities which have prejudiced the development of integrated urban communities and which have thwarted comprehensive planning and development policies. It is therefore perhaps understandable that the administrative boundary and its relationships to physical growth and population numbers should have become a major focus of attention.

Short chapters on the general characteristics and problems of the conurbations serve to open and close a series of regional studies. These deal with the six major English conurbations as defined by the 1951 census, while a further three chapters deal with 'minor conurbations'—though not everyone will readily accept the idea of Scarborough, Scunthorpe or Swindon as belonging even to this category. No major conurbation in South Wales is recognised although a short section in one chapter is devoted to the area. A well-balanced chapter on Scotland has been contributed by Dr C. P. Snodgrass. In many respects indeed, the sections on the minor conurbations and the chapter on Scotland particularly are much more satisfactory for the geographer wishing to understand the contemporary British city.

Paradoxically, although there are no fewer than sixty-six figures comprising over 110 maps, the ones that one might expect to see are frequently not included. In particular, the reader will look in vain for an adequate uniform portrayal of the formal and functional aspects of these British cities. Of the maps no fewer than fifty-one deal solely with administrative units and their historical relationships, a further nineteen are largely so concerned; fifteen deal with purely historical aspects of cities, and only twelve, often severely limited in the range of categories or in areal extent, serve to portray the present functional character of the conurbations.

Although *The Conurbations of Great Britain* has its shortcomings, there is much material of value. Compiled from sources not readily available outside the United Kingdom, it gives fresh approach to the appreciation of the problems and prospects of British cities. Some generalisations are masterly, and along with many of the lucid expositions on the development of the cities they will give new insight into the present urban character. Even if the book may appear to some to be excessively concerned with administrative relationships, it has an important lesson for New Zealanders—namely, that the immense social, economic and administrative problems that have arisen through lack of integrated planning and coordination in Britain provide yet a further salutary and timely warning for the dominion's local and national administrators and planners.—W. J. BROCKIE

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